BBOB 2009: Comparison Tables of All Algorithms on All Noiseless Functions

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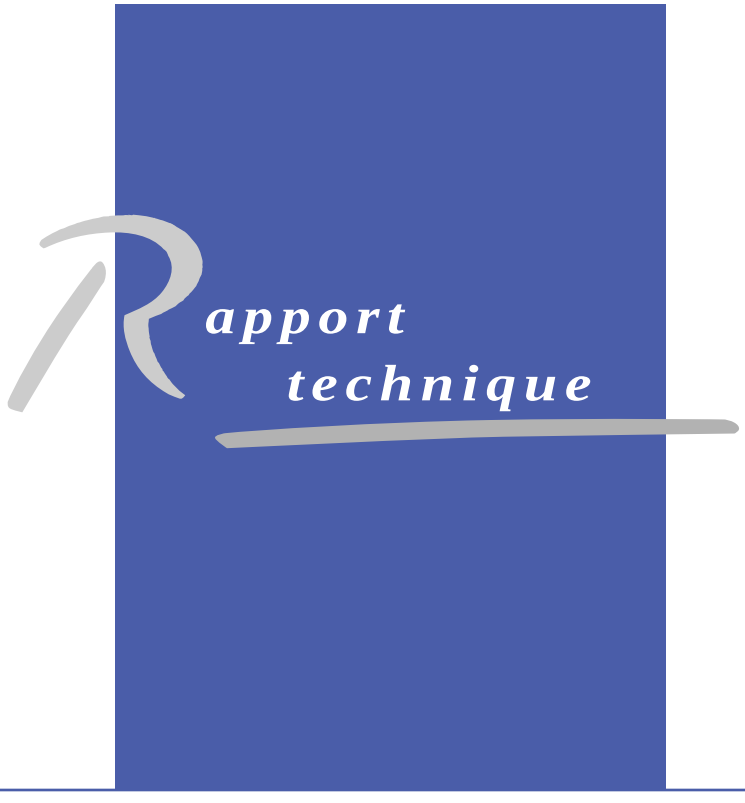

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Abstract: This document presents the results from the BBOB Black-Box Optimization Benchmarking workshop of the GECCO Genetic and Evolutionary Computation Conference 2009 in tables. Each table presents the performance of each algorithm submitted to BBOB 2009 on one function and dimension from the noiseless testbed.

Key-words: continuous optimization, benchmarking

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BBOB 2009: Tables de comparaison de tous les algorithmes sur toutes les fonctions non-bruitées

Résumé : Ce document présente les résultats sous forme de table du workshop Black-Box Optimization Benchmarking (BBOB) de la conférence Genetic and Evolutionary Computation Conference (GECCO), Montréal Canada, 2009. Chaque table présente les performances des algorithmes soumis à BBOB 2009 pour un problème de la suite de fonctions tests.

Mots-clés : optimisation continue, banc d'essai

This document provides tabular results of the workshop for Black-Box Optimization Benchmarking (BBOB) at GECCO 2009[1]. Thirty-one algorithms have been tested on 24 benchmark functions in dimensions between 2 and 40. A description of the used objective functions can be found in [14, 9]. The experimental set-up is described in [13].

The performance measure provided in the following tables is the expected number of objective function evaluations to reach a given target function value (ERT, expected running time), divided by the respective value for the best algorithm. Consequently, the best (smallest) value is 1 and the value 1 appears in each column at least once. If the target was never reached, the median over all trials of the best function value is shown. See [13] for details on how ERT is obtained.

List of Tables

[1] see http://coco.gforge.inria.fr/doku.php?id=bbob-2009

Table 1: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_1 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	0.90	2.8	2.8	3.1	3.1	3.1	3.1	3.1	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	**2.8**	10	56	165	280	427	615	938	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	**2.1**	4.4	11	13	22	27	31	45	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.9**	4.2	18	76	103	138	153	201	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	3.3	3.8	8.5	13	19	23	28	38	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	3.3	**1.2**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	BFGS [30]
Cauchy EDA	**1**	**1**	19	15	27	38	49	61	73	98	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	3.3	3.6	7.6	10	14	18	21	28	(1+1)-CMA-ES [2]
DASA	**1**	**1**	39	23	44	50	60	74	92	120	DASA [19]
DEPSO	**1**	**1**	**2.1**	12	27	45	49	93	121	162	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1.4**	**2.5**	9.1	15	20	31	54	DIRECT [25]
EDA-PSO	**1**	**1**	**1.9**	5.0	20	32	52	78	107	205	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.7**	**1.2**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.9**	6.0	17	18	23	28	33	45	G3-PCX [26]
simple GA	**1**	**1**	**2.7**	7.2	62	300	1042	1755	2516	4316	simple GA [22]
GLOBAL	**1**	**1**	**1.9**	5.7	39	49	52	53	54	56	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**2.3**	3.8	6.7	11	14	19	22	30	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	3.9	5.9	10	14	18	23	27	37	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	7.8	3.2	3.6	4.0	4.0	4.0	4.0	4.0	LSfminbnd [28]
LSstep	**1**	**1**	46	34	62	61	66	66	66	67	LSstep [28]
MA-LS-Chain	**1**	**1**	**2.4**	7.4	26	39	65	83	89	98	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1.5**	**2.2**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	MCS [18]
NELDER (Han)	**1**	**1**	**2.1**	**1.3**	**3.0**	3.8	4.9	6.1	7.2	9.5	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.0**	**1.5**	**2.9**	4.0	5.1	6.3	7.4	10	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.8**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	3.5	**2.8**	6.7	10	14	18	22	29	(1+1)-ES [1]
POEMS	**1**	**1**	173	80	113	383	657	1051	1279	2002	POEMS [20]
PSO	**1**	**1**	**2.1**	5.3	20	57	115	190	246	457	PSO [7]
PSO_Bounds	**1**	**1.1**	**2.4**	6.0	26	86	262	441	749	1183	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.5**	10	49	522	5751	46299	6.55e5	*11e-6/1e6*	Monte Carlo [3]
Rosenbrock	**1**	**1**	5.6	3.1	3.9	4.7	6.0	7.3	8.5	10	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.6**	8.9	25	32	36	42	47	58	VNS (Garcia) [11]

Table 2: Running time excess ERT/ERT_{best} on f_2 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	4.9	6.2	8.2	9.5	12	13	13	14	14	14	ERT_{best}/D
ALPS-GA	11	24	58	123	129	162	204	231	258	330	ALPS-GA [17]
AMaLGaM IDEA	4.9	4.8	6.2	7.6	7.5	9.1	10	11	13	16	AMaLGaM IDEA [4]
BayEDAcG	37	62	80	78	82	87	112	111	139	143	BayEDAcG [10]
BIPOP-CMA-ES	4.0	5.4	13	19	18	18	20	20	20	22	BIPOP-CMA-ES [15]
BFGS	**1.7**	**1.6**	**2.5**	4.0	3.7	3.9	4.1	4.1	4.1	4.4	BFGS [30]
Cauchy EDA	13	17	18	18	18	20	23	24	25	29	Cauchy EDA [24]
(1+1)-CMA-ES	4.1	5.1	10	13	13	13	14	14	15	16	(1+1)-CMA-ES [2]
DASA	21	19	19	22	21	21	23	25	26	31	DASA [19]
DEPSO	10	16	18	26	27	31	35	40	45	53	DEPSO [12]
DIRECT	5.9	5.1	7.5	8.0	7.1	8.5	9.4	12	13	46	DIRECT [25]
EDA-PSO	8.8	11	13	19	20	26	39	49	65	88	EDA-PSO [6]
full NEWUOA	**1.2**	**1.2**	**2.4**	5.8	8.3	10	13	15	18	23	full NEWUOA [31]
G3-PCX	8.6	8.4	14	64	69	76	83	82	82	82	G3-PCX [26]
simple GA	11	44	133	325	422	540	782	994	1260	1894	simple GA [22]
GLOBAL	11	19	19	17	13	13	13	13	13	13	GLOBAL [23]
iAMaLGaM IDEA	**2.6**	3.8	5.1	9.2	9.1	10	11	12	12	14	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.5	5.4	14	19	16	17	18	18	18	20	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1.4**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	14	12	10	10	7.9	7.9	7.8	7.5	7.3	7.3	LSstep [28]
MA-LS-Chain	12	14	17	22	20	24	28	28	29	34	MA-LS-Chain [21]
MCS	**1.5**	**1.6**	**1.4**	**1.8**	**1.7**	**2.6**	3.2	3.3	3.7	23	MCS [18]
NELDER (Han)	**1.9**	**1.8**	**1.7**	**1.8**	**1.8**	**2.0**	**2.2**	**2.4**	**2.6**	**3.0**	NELDER (Han) [16]
NELDER (Doe)	**1.6**	**1.7**	**1.6**	**1.9**	**1.7**	**1.9**	**2.2**	**2.3**	**2.5**	**3.0**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.2**	8.8	12	15	19	23	26	35	NEWUOA [31]
(1+1)-ES	3.2	2407	8656	46584	1.23e5	3.76e5	*74e-3/1e6*	.	.	.	(1+1)-ES [1]
POEMS	138	248	376	421	396	465	514	572	631	780	POEMS [20]
PSO	7.5	14	56	83	83	98	118	132	156	195	PSO [7]
PSO_Bounds	6.9	24	54	174	307	356	403	442	531	785	PSO_Bounds [8]
Monte Carlo	21	50	244	1216	5649	1.00e5	*94e-4/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	**2.6**	3.1	**2.5**	3.7	4.4	5.4	6.3	6.5	6.9	7.9	Rosenbrock [27]
VNS (Garcia)	8.4	15	22	27	24	25	26	26	26	29	VNS (Garcia) [11]

Table 3: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_3 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.70	7.3	135	222	223	225	226	227	232	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.1**	**1.6**	9.2	6.7	6.4	11	12	15	19	23	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	**1.1**	3.7	4.6	12	12	12	12	13	13	AMaLGaM IDEA [4]
BayEDAcG	**1.1**	**1.2**	4.4	4.0	10	18	41	65	65	64	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.2**	3.5	3.5	5.2	6.2	6.4	6.5	6.5	6.7	BIPOP-CMA-ES [15]
BFGS	**1.2**	18	14	3.1	10	10	10	10	10	10	BFGS [30]
Cauchy EDA	**1.1**	10	10	3.3	8.4	33	43	43	43	43	Cauchy EDA [24]
(1+1)-CMA-ES	**1.0**	**1.9**	6.9	3.8	7.9	7.9	7.9	7.9	7.9	7.8	(1+1)-CMA-ES [2]
DASA	6.3	22	18	**1.8**	6.9	7.0	7.1	7.2	7.4	7.6	DASA [19]
DEPSO	**1.8**	**2.0**	5.7	**2.3**	**2.7**	4.0	4.5	5.0	5.4	6.4	DEPSO [12]
DIRECT	**1**	**1.1**	**2.7**	**1.0**	**2.4**	**2.4**	**2.5**	**2.6**	**2.7**	**3.0**	DIRECT [25]
EDA-PSO	**1.2**	**1.4**	4.8	6.4	14	19	20	20	21	22	EDA-PSO [6]
full NEWUOA	**1**	4.0	**2.3**	**1.8**	**2.2**	**2.2**	**2.2**	**2.1**	**2.1**	**2.1**	full NEWUOA [31]
G3-PCX	**1.1**	**2.0**	4.1	7.8	40	40	39	39	39	39	G3-PCX [26]
simple GA	**1**	**2.0**	8.3	13	19	27	40	55	70	108	simple GA [22]
GLOBAL	**1.1**	**1.6**	7.0	**1.8**	3.1	3.1	3.1	3.1	3.1	3.1	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.4**	**1.8**	6.3	17	17	17	17	17	17	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.5**	**2.3**	3.4	7.6	8.4	9.2	9.4	10	10	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.1**	4.7	17	32	43	64	63	63	63	61	LSfminbnd [28]
LSstep	28	116	24	**1.5**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1**	**1.5**	5.7	**1.7**	**2.5**	**2.6**	**2.7**	**2.7**	**2.8**	**2.9**	MA-LS-Chain [21]
MCS	**1**	**1.1**	**1.5**	**1.1**	**1.5**	**1.6**	**1.6**	**2.6**	**2.6**	**2.6**	MCS [18]
NELDER (Han)	**1.2**	**1.8**	**1.4**	4.0	13	13	13	13	12	12	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1**	**1**	**1.7**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	NELDER (Doe) [5]
NEWUOA	**1.5**	**2.4**	4.8	**1.5**	4.2	4.2	4.2	4.1	4.1	4.1	NEWUOA [31]
(1+1)-ES	**1.1**	**2.4**	12	5.0	15	15	15	15	15	14	(1+1)-ES [1]
POEMS	31	205	42	11	14	20	24	29	32	41	POEMS [20]
PSO	**1.1**	**1.6**	5.1	3.3	3.4	4.7	6.0	7.2	8.8	11	PSO [7]
PSO_Bounds	**1.1**	**1.8**	4.8	5.3	8.3	14	18	22	26	34	PSO_Bounds [8]
Monte Carlo	**1.1**	**1.5**	14	67	464	3098	20592	*39e-4 /1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	16	45	15	26	26	26	26	26	25	Rosenbrock [27]
VNS (Garcia)	**1**	**1.9**	8.8	**2.9**	4.1	4.2	4.2	4.5	4.7	7.7	VNS (Garcia) [11]

Table 4: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_4 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	11	172	230	248	261	270	272	283	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**2.5**	9.0	7.1	8.3	10	12	15	17	20	ALPS-GA [17]
AMaLGaM IDEA	**1**	**2.2**	**2.6**	5.6	51	48	48	46	47	45	AMaLGaM IDEA [4]
BayEDAcG	**1**	**2.3**	4.5	13	62	117	112	*10e-1/2e3*	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	3.8	**2.6**	6.9	55	97	99	98	99	106	BIPOP-CMA-ES [15]
BFGS	**1**	13	11	5.7	12	11	11	10	10	10	BFGS [30]
Cauchy EDA	**1**	19	6.8	13	75	405	468	454	450	433	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**2.4**	5.2	5.5	27	25	24	23	23	22	(1+1)-CMA-ES [2]
DASA	**1**	82	15	**2.0**	3.6	3.4	3.3	3.3	3.4	3.4	DASA [19]
DEPSO	**1**	**2.4**	7.2	4.2	6.5	11	17	17	17	35	DEPSO [12]
DIRECT	**1**	**1**	**1.8**	**1.8**	6.6	6.1	14	14	16	16	DIRECT [25]
EDA-PSO	**1**	**2.6**	4.2	10	18	19	19	19	19	20	EDA-PSO [6]
full NEWUOA	**1**	3.8	5.4	3.9	15	14	13	13	13	12	full NEWUOA [31]
G3-PCX	**1**	**2.1**	20	17	76	70	67	65	64	62	G3-PCX [26]
simple GA	**1**	**2.6**	10	16	22	28	37	49	60	105	simple GA [22]
GLOBAL	**1**	**2.4**	8.5	**1.2**	5.2	4.8	4.6	4.5	4.5	4.3	GLOBAL [23]
iAMaLGaM IDEA	**1**	3.8	**2.5**	9.5	61	57	56	55	55	54	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	3.5	**3.0**	8.7	75	178	267	259	258	249	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	4.6	**1**	45	119	226	*10e-1/4e3*	.	.	.	LSfminbnd [28]
LSstep	**1**	216	19	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1**	**2.3**	5.6	**1.8**	4.4	4.2	4.1	4.0	4.1	4.1	MA-LS-Chain [21]
MCS	**1**	**1**	**2.0**	**1**	**2.9**	**2.7**	**2.7**	**2.7**	**2.7**	**2.6**	MCS [18]
NELDER (Han)	**1**	3.1	5.0	5.3	27	25	24	23	23	22	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.1**	**1.9**	**1.4**	**3.5**	**3.2**	**3.1**	**3.0**	**3.0**	**3.0**	NELDER (Doe) [5]
NEWUOA	**1**	3.0	5.0	4.5	18	16	16	15	15	14	NEWUOA [31]
(1+1)-ES	**1**	3.1	4.5	5.5	23	21	20	20	20	19	(1+1)-ES [1]
POEMS	**1**	237	36	10	22	23	29	32	35	41	POEMS [20]
PSO	**1.1**	3.2	4.0	3.3	4.6	5.6	6.4	7.4	8.7	11	PSO [7]
PSO_Bounds	**1**	3.3	4.4	6.3	10	17	21	24	27	33	PSO_Bounds [8]
Monte Carlo	**1**	3.3	8.6	67	617	8200	27936	54724	*11e-3/1e6*	.	Monte Carlo [3]
Rosenbrock	**1**	71	27	15	52	48	46	44	44	42	Rosenbrock [27]
VNS (Garcia)	**1**	**2.6**	5.1	4.1	8.8	8.2	7.9	8.3	8.8	17	VNS (Garcia) [11]

Table 5: Running time excess ERT/ERT_{best} on f_5 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.50	0.50	1.8	2.2	2.2	2.2	2.2	2.2	2.2	2.2	ERT_{best}/D
ALPS-GA	**1**	**1.1**	8.8	76	100	104	104	104	104	104	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	5.3	16	18	18	18	18	18	18	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	3.3	92	102	103	103	103	103	103	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	3.4	5.3	5.7	5.8	5.8	5.8	5.8	5.8	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	**1.5**	**2.8**	**2.8**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	BFGS [30]
Cauchy EDA	**1**	**1**	16	17	17	17	17	17	17	17	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	**1.9**	3.1	3.4	3.4	3.4	3.4	3.4	3.4	(1+1)-CMA-ES [2]
DASA	**1**	**1.9**	19	32	40	46	53	60	66	80	DASA [19]
DEPSO	**1**	**1**	6.1	34	35	36	36	36	36	36	DEPSO [12]
DIRECT	**1**	**1**	3.4	**2.8**	4.2	4.2	4.2	4.2	4.2	4.2	DIRECT [25]
EDA-PSO	**1**	**1**	5.0	15	16	17	17	17	17	17	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	**1**	**1.2**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	full NEWUOA [31]
G3-PCX	**1**	**1.1**	4.1	29	31	31	31	31	31	31	G3-PCX [26]
simple GA	**1**	**1**	4.2	306	1957	4247	6326	9795	15125	6.80e5	simple GA [22]
GLOBAL	**1**	**1.1**	4.4	69	70	70	70	70	70	70	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	4.6	12	13	13	13	13	13	13	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	4.0	6.6	7.1	7.1	7.1	7.1	7.1	7.1	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	4.9	7.3	8.5	9.1	9.1	9.1	9.1	9.1	LSfminbnd [28]
LSstep	**1**	**1.2**	59	79	91	91	91	91	91	91	LSstep [28]
MA-LS-Chain	**1**	**1.1**	4.7	81	123	126	126	126	126	126	MA-LS-Chain [21]
MCS	**1**	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1**	**1**	**1.8**	**2.1**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.3**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.1**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	NEWUOA [31]
(1+1)-ES	**1**	**1**	**1.9**	**2.4**	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	(1+1)-ES [1]
POEMS	**1**	**1**	138	154	173	181	185	185	185	185	POEMS [20]
PSO	**1**	**1.1**	4.2	18	20	21	21	21	21	21	PSO [7]
PSO_Bounds	**1**	**1**	6.1	13	16	16	16	16	16	16	PSO_Bounds [8]
Monte Carlo	**1**	**1**	4.4	529	49212	*22e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	3.5	3.4	3.5	3.5	3.5	3.5	3.5	3.5	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	6.3	27	27	27	27	27	27	27	VNS (Garcia) [11]

Table 6: Running time excess ERT/ERT_{best} on f_6 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.83	1.4	6.3	11	20	27	34	40	47	62	ERT_{best}/D
ALPS-GA	3.2	3.2	**2.2**	12	31	50	62	73	80	83	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	**1.4**	**2.1**	4.5	4.9	5.5	6.2	6.5	6.7	7.0	AMaLGaM IDEA [4]
BayEDAcG	**2.8**	**1.9**	**1.5**	164	640	*72e-2/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.9	**3.0**	**2.0**	**2.8**	3.6	3.9	4.2	4.2	4.1	4.3	BIPOP-CMA-ES [15]
BFGS	4.3	4.4	4.2	3.4	**2.7**	**2.4**	**2.0**	**1.9**	**1.7**	**1.6**	BFGS [30]
Cauchy EDA	11	10	16	18	17	17	17	17	16	16	Cauchy EDA [24]
(1+1)-CMA-ES	4.2	3.3	**2.1**	**3.0**	**2.3**	**2.2**	**2.2**	**2.3**	**2.2**	**2.1**	(1+1)-CMA-ES [2]
DASA	30	29	23	22	18	19	19	18	18	18	DASA [19]
DEPSO	**1.7**	**1.7**	3.8	11	12	14	14	15	16	17	DEPSO [12]
DIRECT	**1.4**	**1**	**1.4**	7.6	5.8	125	801	1455	1232	972	DIRECT [25]
EDA-PSO	3.4	**2.4**	3.1	12	12	15	19	27	29	34	EDA-PSO [6]
full NEWUOA	**1**	**2.2**	3.4	3.7	3.2	3.5	3.7	3.7	4.1	4.5	full NEWUOA [31]
G3-PCX	**2.3**	**1.5**	**2.3**	4.5	3.7	3.9	3.9	3.8	3.8	4.1	G3-PCX [26]
simple GA	4.8	3.4	3.5	14	85	1004	3073	4055	3586	4893	simple GA [22]
GLOBAL	3.7	**2.9**	**2.3**	8.8	7.4	6.2	5.2	4.5	3.9	3.2	GLOBAL [23]
iAMaLGaM IDEA	**2.7**	**1.9**	**2.4**	3.6	3.8	4.0	4.1	4.2	4.3	4.4	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.7	3.1	**1.7**	4.1	3.8	4.5	4.6	4.7	4.6	4.4	IPOP-SEP-CMA-ES [29]
LSfminbnd	19	187	283	375	289	258	210	179	154	121	LSfminbnd [28]
LSstep	53	329	913	579	375	332	709	1151	*17e-4/1e4*	.	LSstep [28]
MA-LS-Chain	4.4	**2.9**	**2.2**	13	14	14	12	12	10	10	MA-LS-Chain [21]
MCS	**1.4**	195	52	29	19	42	102	114	102	117	MCS [18]
NELDER (Han)	**2.1**	**1.5**	**1**	**1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	NELDER (Han) [16]
NELDER (Doe)	**1.6**	**2.0**	**1.3**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.2**	**2.4**	4.4	4.7	3.9	4.4	4.7	4.8	5.0	4.9	NEWUOA [31]
(1+1)-ES	**2.4**	**2.2**	**2.5**	3.7	3.6	3.6	3.4	3.4	3.3	3.2	(1+1)-ES [1]
POEMS	205	155	99	133	117	138	134	144	182	179	POEMS [20]
PSO	**1.5**	**1.1**	**2.1**	4.6	7.9	18	23	29	32	36	PSO [7]
PSO_Bounds	**2.2**	**1.5**	**2.6**	7.0	37	77	133	137	136	166	PSO_Bounds [8]
Monte Carlo	3.0	**2.3**	**2.7**	16	53	783	13169	81456	1.50e5	*28e-5/1e6*	Monte Carlo [3]
Rosenbrock	4.0	3.0	**2.2**	**2.1**	**1.8**	**1.8**	**1.8**	**1.8**	**1.7**	**1.5**	Rosenbrock [27]
VNS (Garcia)	**2.6**	**2.7**	**1.9**	7.2	6.9	6.7	6.3	6.3	6.1	5.7	VNS (Garcia) [11]

Table 7: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_7 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	1	1.6	11	30	97	108	108	108	121	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.1**	**1.4**	4.1	4.7	12	9.5	11	11	11	13	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	**1.5**	3.4	20	8.1	**2.7**	**2.5**	**2.5**	**2.5**	**2.4**	AMaLGaM IDEA [4]
BayEDAcG	**1.5**	**1.7**	4.2	3.1	79	85	76	76	76	109	BayEDAcG [10]
BIPOP-CMA-ES	**1.9**	**1.9**	3.2	**2.6**	3.4	**1.5**	**1.5**	**1.5**	**1.5**	**1.6**	BIPOP-CMA-ES [15]
BFGS	**1.6**	3.7	10	19	34	*76e-2/200*	.	.	.	.	BFGS [30]
Cauchy EDA	5.5	8.4	19	7.6	5.3	**2.0**	**1.9**	**1.9**	**1.9**	**2.1**	Cauchy EDA [24]
(1+1)-CMA-ES	**1.5**	**1.4**	**2.7**	**1.8**	**2.8**	**1**	**1**	**1**	**1**	**1**	(1+1)-CMA-ES [2]
DASA	30	59	171	167	309	242	436	436	436	392	DASA [19]
DEPSO	**1.7**	**1.7**	6.5	4.8	4.9	**2.6**	3.1	3.1	3.1	3.6	DEPSO [12]
DIRECT	**1.4**	**1**	**2.1**	**1.3**	**1**	**2.7**	**3.0**	**3.0**	**3.0**	**2.7**	DIRECT [25]
EDA-PSO	**1.5**	**1.8**	3.7	3.1	6.2	6.2	9.0	9.0	9.0	14	EDA-PSO [6]
full NEWUOA	**1.9**	**2.7**	**2.0**	3.7	3.7	**1.7**	**2.9**	**2.9**	**2.9**	**2.7**	full NEWUOA [31]
G3-PCX	**1.3**	**1.5**	4.5	12	35	19	21	21	21	19	G3-PCX [26]
simple GA	**1.6**	**1.6**	5.2	3.9	22	24	47	47	47	67	simple GA [22]
GLOBAL	**1.2**	**1.8**	6.8	4.1	7.5	**2.7**	4.4	4.4	4.4	3.9	GLOBAL [23]
iAMaLGaM IDEA	**1.8**	**1.8**	3.9	12	4.7	**2.8**	**2.5**	**2.5**	**2.5**	**2.4**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**2.1**	5.5	**2.7**	**2.8**	**1.2**	**1.3**	**1.3**	**1.3**	**1.5**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1.3**	**1.1**	6.3	11	66	55	495	495	495	965	LSfminbnd [28]
LSstep	28	28	260	245	457	1515	*29e-3/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1.7**	**2.3**	5.8	3.4	4.7	3.6	4.6	4.6	4.6	4.7	MA-LS-Chain [21]
MCS	**1.4**	**1.4**	**1**	4.1	4.5	**2.2**	6.5	6.5	6.5	6.0	MCS [18]
NELDER (Han)	**1.5**	**1.3**	**2.5**	25	18	6.6	6.5	6.5	6.5	5.9	NELDER (Han) [16]
NELDER (Doe)	**1.8**	**1.6**	**2.6**	**1**	8.5	5.4	5.2	5.2	5.2	5.4	NELDER (Doe) [5]
NEWUOA	**1.7**	**2.0**	**2.5**	9.3	9.3	6.0	14	14	14	12	NEWUOA [31]
(1+1)-ES	**2.3**	3.3	5.6	4.1	4.3	**1.8**	3.3	3.3	3.3	3.0	(1+1)-ES [1]
POEMS	218	214	180	45	41	21	23	23	23	28	POEMS [20]
PSO	**1.5**	**1.3**	4.1	3.5	4.8	3.2	3.6	3.6	3.6	4.4	PSO [7]
PSO_Bounds	**1.3**	**1.6**	6.2	3.4	5.8	5.0	6.7	6.7	6.7	14	PSO_Bounds [8]
Monte Carlo	**1.7**	**1.5**	4.6	4.5	43	87	150	150	150	952	Monte Carlo [3]
Rosenbrock	16	42	155	119	166	78	189	189	189	170	Rosenbrock [27]
VNS (Garcia)	**1**	**2.4**	3.9	3.8	5.1	**2.1**	**2.0**	**2.0**	**2.0**	**2.0**	VNS (Garcia) [11]

Table 8: Running time excess ERT/ERT_{best} on f_8 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.60	1.6	2.7	6.0	18	23	43	46	47	56	ERT_{best}/D
ALPS-GA	**2.9**	**2.8**	4.7	19	31	66	54	74	94	131	ALPS-GA [17]
AMaLGaM IDEA	**2.4**	4.1	6.2	10	6.8	7.0	4.4	4.7	5.1	5.0	AMaLGaM IDEA [4]
BayEDAcG	**2.3**	**2.9**	5.6	11	48	354	*53e-3/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.1	3.3	3.5	7.1	9.2	11	6.4	6.5	6.7	6.2	BIPOP-CMA-ES [15]
BFGS	7.5	4.9	4.1	5.1	**2.4**	**2.2**	**1.3**	**1.3**	**1.3**	**1.1**	BFGS [30]
Cauchy EDA	15	11	10	24	19	21	12	13	14	13	Cauchy EDA [24]
(1+1)-CMA-ES	6.4	4.3	3.8	11	6.9	7.0	4.2	4.1	4.3	4.0	(1+1)-CMA-ES [2]
DASA	31	33	108	520	484	678	522	580	698	822	DASA [19]
DEPSO	4.0	3.3	3.6	14	15	25	28	42	65	*76e-7/2e3*	DEPSO [12]
DIRECT	**1**	**1**	**1.4**	**5.0**	4.4	8.7	10	16	17	21	DIRECT [25]
EDA-PSO	**1.9**	**3.0**	5.4	11	50	98	97	141	176	216	EDA-PSO [6]
full NEWUOA	6.6	3.9	7.0	7.0	3.2	**2.8**	**1.6**	**1.5**	**1.5**	**1.3**	full NEWUOA [31]
G3-PCX	**2.8**	4.0	5.0	24	16	18	11	11	11	10	G3-PCX [26]
simple GA	**2.0**	**2.9**	8.4	34	87	169	1342	8897	*61e-5/1e5*	.	simple GA [22]
GLOBAL	4.4	4.5	14	19	8.2	7.2	4.1	3.9	3.9	3.4	GLOBAL [23]
iAMaLGaM IDEA	**2.3**	**2.8**	4.4	12	8.0	8.4	5.0	5.2	5.5	5.2	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	6.4	3.9	5.2	19	17	17	10	9.3	10	8.7	IPOP-SEP-CMA-ES [29]
LSfminbnd	16	7.0	423	1541	2305	6304	*90e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	67	51	37	1481	3558	6070	*32e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**2.7**	3.6	7.2	16	10	15	9.0	8.8	9.0	8.5	MA-LS-Chain [21]
MCS	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1.9**	**1.4**	**2.1**	**3.7**	**2.0**	**2.0**	**1.1**	**1.2**	**1.2**	**1.2**	NELDER (Han) [16]
NELDER (Doe)	3.0	3.2	4.6	6.2	**2.9**	**2.7**	**1.6**	**1.5**	**1.6**	**1.5**	NELDER (Doe) [5]
NEWUOA	3.8	**2.8**	4.3	7.0	3.5	3.2	**1.9**	**1.8**	**1.8**	**1.6**	NEWUOA [31]
(1+1)-ES	**2.3**	**2.2**	47	59	23	34	35	51	70	95	(1+1)-ES [1]
POEMS	227	113	121	106	76	108	74	91	116	129	POEMS [20]
PSO	**2.7**	**2.6**	6.5	11	16	27	26	37	49	67	PSO [7]
PSO_Bounds	3.7	4.3	6.0	19	24	61	69	122	148	205	PSO_Bounds [8]
Monte Carlo	**2.7**	3.2	5.8	19	72	674	2214	39156	3.14e5	*17e-5/1e6*	Monte Carlo [3]
Rosenbrock	5.8	3.4	4.9	10	5.2	4.8	**2.8**	**2.7**	**2.8**	**2.5**	Rosenbrock [27]
VNS (Garcia)	10	4.8	8.1	16	10	11	6.9	6.8	7.2	6.7	VNS (Garcia) [11]

Table 9: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_9 in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	0.50	8.9	15	22	34	38	41	46	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	3.3	7.2	33	19	41	62	64	81	100	143	ALPS-GA [17]
AMaLGaM IDEA	4.2	13	22	6.3	9.5	10	7.5	7.4	7.7	7.6	AMaLGaM IDEA [4]
BayEDAcG	3.8	11	29	10	99	598	*66e-3/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.6**	10	19	4.6	7.1	7.5	5.8	5.6	5.8	5.9	BIPOP-CMA-ES [15]
BFGS	4.2	9.2	16	**2.4**	**2.3**	**1.9**	**1.4**	**1.3**	**1.2**	**1.1**	BFGS [30]
Cauchy EDA	16	37	59	14	20	19	14	14	14	14	Cauchy EDA [24]
(1+1)-CMA-ES	3.5	10	26	8.8	8.0	7.3	5.4	5.0	5.0	4.9	(1+1)-CMA-ES [2]
DASA	65	113	318	246	290	326	317	382	548	738	DASA [19]
DEPSO	**2.7**	12	58	12	12	20	19	25	45	97	DEPSO [12]
DIRECT	**1**	**1**	**1**	**2.0**	5.0	5.8	8.3	14	18	25	DIRECT [25]
EDA-PSO	3.8	12	47	8.5	27	51	78	123	151	205	EDA-PSO [6]
full NEWUOA	7.1	12	24	**2.7**	**2.2**	**1.8**	**1.3**	**1.2**	**1.1**	**1.1**	full NEWUOA [31]
G3-PCX	4.1	10	28	15	20	18	14	13	13	11	G3-PCX [26]
simple GA	5.0	15	44	22	90	193	2167	2178	10262	14675	simple GA [22]
GLOBAL	3.5	11	30	9.1	11	7.9	5.2	4.7	4.5	4.2	GLOBAL [23]
iAMaLGaM IDEA	3.1	7.9	29	6.0	7.2	6.9	5.3	5.1	5.3	5.3	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.1	9.5	16	7.6	15	14	10	9.3	9.4	9.0	IPOP-SEP-CMA-ES [29]
LSfminbnd	6.2	15	20	212	666	3120	4143	3637	3441	*76e-3/1e4*	LSfminbnd [28]
LSstep	266	613	747	227	671	1833	2087	3808	*76e-3/1e4*	.	LSstep [28]
MA-LS-Chain	5.0	10	35	8.6	13	13	11	10	10	11	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**2.7**	**3.6**	**10**	**1.6**	**2.0**	**1.8**	**1.3**	**1.2**	**1.2**	**1.2**	NELDER (Han) [16]
NELDER (Doe)	4.1	6.9	11	**2.3**	**2.6**	**2.1**	**1.5**	**1.4**	**1.4**	**1.4**	NELDER (Doe) [5]
NEWUOA	5.2	8.3	24	3.6	3.3	**2.7**	**1.9**	**1.8**	**1.8**	**1.7**	NEWUOA [31]
(1+1)-ES	4.4	8.1	19	81	116	116	101	114	133	159	(1+1)-ES [1]
POEMS	360	449	559	65	78	114	98	111	132	163	POEMS [20]
PSO	4.0	15	37	8.7	12	24	28	38	49	67	PSO [7]
PSO_Bounds	3.9	9.0	48	11	27	96	122	157	197	240	PSO_Bounds [8]
Monte Carlo	3.0	10	47	17	113	897	3606	68989	3.65e5	*16e-5/1e6*	Monte Carlo [3]
Rosenbrock	8.9	12	22	**2.6**	3.1	**2.9**	**2.2**	**2.2**	**2.2**	**2.2**	Rosenbrock [27]
VNS (Garcia)	4.8	21	45	14	15	12	10	9.4	10	10	VNS (Garcia) [11]

Table 10: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{10} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.9	5.7	15	23	27	30	34	38	41	49	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	22	25	47	69	164	353	776	1644	2079	3203	ALPS-GA [17]
AMaLGaM IDEA	6.7	5.7	3.0	3.0	3.8	4.0	4.1	4.1	4.3	4.4	AMaLGaM IDEA [4]
BayEDAcG	17	13	60	188	313	*33e-1/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	12	12	7.9	9.0	8.5	7.9	7.7	7.4	7.3	6.8	BIPOP-CMA-ES [15]
BFGS	**2.3**	**1.5**	**1**	**1.4**	**1.4**	**1.4**	**1.4**	**2.6**	6.3	24	BFGS [30]
Cauchy EDA	14	13	7.4	6.4	7.0	7.0	7.4	7.7	8.0	8.4	Cauchy EDA [24]
(1+1)-CMA-ES	7.3	5.8	7.2	6.6	6.3	5.8	5.5	5.3	5.2	4.8	(1+1)-CMA-ES [2]
DASA	22	15	8920	51851	60955	95121	1.21e5	1.09e5	1.02e5	85710	DASA [19]
DEPSO	16	26	80	111	328	312	*51e-2/2e3*	.	.	.	DEPSO [12]
DIRECT	3.9	4.3	3.9	9.5	20	68	116	187	223	456	DIRECT [25]
EDA-PSO	17	26	43	139	330	645	1113	2126	3000	8601	EDA-PSO [6]
full NEWUOA	**2.0**	**3.0**	3.8	4.5	6.0	6.4	7.1	7.7	8.2	9.0	full NEWUOA [31]
G3-PCX	11	10	26	39	39	37	34	31	29	25	G3-PCX [26]
simple GA	27	51	77	702	2828	4294	41912	37827	*23e-3/1e5*	.	simple GA [22]
GLOBAL	18	19	11	7.4	6.4	5.8	5.3	4.9	4.6	4.0	GLOBAL [23]
iAMaLGaM IDEA	5.5	4.0	3.3	3.7	4.1	4.1	4.0	4.1	4.2	4.1	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	8.3	12	16	14	16	15	13	12	12	11	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1.8**	**1**	767	6307	*15e+0/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**2.1**	**1.2**	768	2843	*15e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	16	20	13	18	19	20	19	18	18	17	MA-LS-Chain [21]
MCS	**1**	**1.2**	**1.7**	8.7	47	132	522	1086	1298	3736	MCS [18]
NELDER (Han)	**3.0**	**2.2**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	NELDER (Han) [16]
NELDER (Doe)	3.2	**2.2**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**2.3**	**1.9**	3.1	4.3	6.5	7.3	8.5	10	10	11	NEWUOA [31]
(1+1)-ES	6.3	5.3	8678	24076	76637	1.52e5	4.35e5	*13e-2/1e6*	.	.	(1+1)-ES [1]
POEMS	109	90	303	542	1442	2068	2359	3198	3729	6436	POEMS [20]
PSO	23	26	182	285	477	654	855	986	1109	1915	PSO [7]
PSO_Bounds	21	24	535	768	744	834	1532	1879	1938	2096	PSO_Bounds [8]
Monte Carlo	23	55	112	687	3906	44460	1.30e5	3.78e5	*61e-4/1e6*	.	Monte Carlo [3]
Rosenbrock	4.8	**2.8**	3.1	3.4	3.2	3.0	**2.9**	**2.8**	**3.2**	**3.0**	Rosenbrock [27]
VNS (Garcia)	22	25	17	12	12	11	10	9.4	9.1	8.3	VNS (Garcia) [11]

Table 11: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.7	5.7	18	22	25	31	34	38	41	49	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	17	40	35	80	202	412	882	1151	1735	3391	ALPS-GA [17]
AMaLGaM IDEA	4.8	5.4	**3.0**	3.5	4.2	3.9	4.2	4.4	4.4	4.6	AMaLGaM IDEA [4]
BayEDAcG	9.3	18	31	148	1121	*14e-1/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.7	8.7	7.9	8.8	9.2	8.2	8.0	7.6	7.5	6.8	BIPOP-CMA-ES [15]
BFGS	**1.6**	**1.7**	**1.2**	**1.6**	**2.0**	**1.7**	**1.9**	**2.7**	5.7	36	BFGS [30]
Cauchy EDA	13	15	6.7	7.4	8.1	8.0	8.3	8.1	8.9	9.0	Cauchy EDA [24]
(1+1)-CMA-ES	4.8	5.9	5.8	6.4	6.6	5.7	5.6	5.4	5.1	4.7	(1+1)-CMA-ES [2]
DASA	15	15	9043	39511	53951	56697	53194	49726	47414	41516	DASA [19]
DEPSO	24	34	34	105	*45e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	3.3	5.1	**2.6**	5.2	28	49	58	193	274	458	DIRECT [25]
EDA-PSO	8.6	27	96	264	461	991	1910	2850	6542	*36e-6/1e5*	EDA-PSO [6]
full NEWUOA	**1.6**	3.5	**2.7**	4.4	6.2	6.2	7.0	7.7	8.0	8.6	full NEWUOA [31]
G3-PCX	10	9.1	10	25	28	36	35	33	32	27	G3-PCX [26]
simple GA	20	57	53	218	5039	45928	*14e-2/1e5*	.	.	.	simple GA [22]
GLOBAL	17	23	9.2	7.5	6.9	5.8	5.4	4.9	4.6	4.0	GLOBAL [23]
iAMaLGaM IDEA	4.5	6.0	**2.8**	3.3	4.0	3.8	4.0	3.9	3.9	4.0	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	5.4	6.9	13	17	17	14	13	13	12	11	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.1**	**1.8**	497	2889	5548	*96e-1/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	**1.0**	**1**	378	1778	2576	*81e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	12	15	11	18	23	21	20	20	20	17	MA-LS-Chain [21]
MCS	**1**	**1.1**	87	124	166	296	920	1283	2042	*91e-5/3e4*	MCS [18]
NELDER (Han)	**2.0**	**2.1**	**1.0**	**1.1**	**1.1**	**1.0**	**1.1**	**1.1**	**1.1**	**1.0**	NELDER (Han) [16]
NELDER (Doe)	**2.2**	**2.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.2**	**1.5**	**1.5**	3.2	5.5	6.1	6.9	7.7	8.4	11	NEWUOA [31]
(1+1)-ES	4.2	853	7687	20883	60012	2.26e5	4.40e5	*63e-3/1e6*	.	.	(1+1)-ES [1]
POEMS	55	83	1037	1399	2113	2805	3995	6496	7947	7122	POEMS [20]
PSO	10	23	478	531	664	673	856	1047	1287	1876	PSO [7]
PSO_Bounds	11	21	3228	5208	6281	5463	6735	6297	6082	5474	PSO_Bounds [8]
Monte Carlo	16	51	94	872	6299	42870	2.12e5	*97e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**2.3**	**2.9**	**2.4**	**2.7**	3.0	**2.7**	**2.6**	**2.5**	**2.6**	**2.5**	Rosenbrock [27]
VNS (Garcia)	8.4	14	12	12	12	11	10	10	9.4	8.6	VNS (Garcia) [11]

Table 12: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{12} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	5.0	9.2	18	23	38	47	52	63	76	97	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	19	37	38	51	76	94	130	211	227	374	ALPS-GA [17]
AMaLGaM IDEA	5.4	4.1	5.6	13	17	17	17	18	16	15	AMaLGaM IDEA [4]
BayEDAcG	40	26	66	87	*67e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	6.0	6.1	7.5	12	10	9.1	9.0	11	10	8.2	BIPOP-CMA-ES [15]
BFGS	**1.8**	**1.1**	**1.2**	3.2	3.1	**2.9**	**2.8**	**2.6**	**2.4**	4.2	BFGS [30]
Cauchy EDA	11	10	13	24	19	18	18	17	15	14	Cauchy EDA [24]
(1+1)-CMA-ES	4.9	7.0	9.0	13	10	8.9	8.7	7.6	6.5	5.6	(1+1)-CMA-ES [2]
DASA	16	64	2587	6771	6085	8767	14045	11796	9749	7895	DASA [19]
DEPSO	17	16	40	55	51	48	45	40	35	45	DEPSO [12]
DIRECT	3.0	3.3	5.9	35	80	70	164	266	248	287	DIRECT [25]
EDA-PSO	11	24	39	98	159	304	794	1043	1012	821	EDA-PSO [6]
full NEWUOA	**1.4**	**1.9**	4.4	5.2	3.8	3.4	3.3	3.0	**2.7**	**2.4**	full NEWUOA [31]
G3-PCX	9.1	6.1	12	29	34	34	32	31	29	28	G3-PCX [26]
simple GA	23	39	89	171	575	1009	2406	2659	2227	1873	simple GA [22]
GLOBAL	11	11	7.8	8.3	7.2	6.3	6.4	5.9	5.0	4.4	GLOBAL [23]
iAMaLGaM IDEA	4.1	**2.5**	4.3	7.0	6.4	6.4	6.4	6.0	5.8	5.4	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	7.4	9.2	7.2	10	10	8.8	8.5	8.1	7.0	6.3	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1.7**	**1**	564	1228	771	628	574	489	410	332	LSfminbnd [28]
LSstep	505	275	287	230	234	349	722	604	818	641	LSstep [28]
MA-LS-Chain	13	13	11	15	13	12	13	13	12	10	MA-LS-Chain [21]
MCS	**1**	**1.1**	59	49	32	26	24	28	39	30	MCS [18]
NELDER (Han)	**1.9**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**2.0**	**1.4**	**1.0**	**1.6**	**1.6**	**1.7**	**1.7**	**1.6**	**1.4**	**1.3**	NELDER (Doe) [5]
NEWUOA	**1.5**	**1.1**	**1.8**	**2.9**	**2.3**	**2.1**	**2.0**	**1.8**	**1.6**	**1.4**	NEWUOA [31]
(1+1)-ES	3.8	1518	6496	17429	23040	54745	1.27e5	2.26e5	1.90e5	*25e-3/1e6*	(1+1)-ES [1]
POEMS	64	79	80	652	1051	1202	1606	2064	2911	14969	POEMS [20]
PSO	11	12	18	57	112	132	161	185	216	299	PSO [7]
PSO_Bounds	12	19	220	441	391	507	685	630	560	560	PSO_Bounds [8]
Monte Carlo	18	27	92	585	3204	15580	1.36e5	*38e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	3.3	**2.9**	**2.4**	3.6	**3.0**	5.4	5.1	4.5	3.9	3.3	Rosenbrock [27]
VNS (Garcia)	17	17	14	13	8.8	7.5	7.1	6.4	5.6	4.9	VNS (Garcia) [11]

Table 13: Running time excess ERT/ERT$_{\text{best}}$ on f_{13} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.50	2.3	11	18	23	30	35	42	47	61	ERT$_{\text{best}}$/D
ALPS-GA	**1.3**	3.2	13	47	103	171	300	1251	3742	29283	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	3.4	**2.6**	3.2	3.6	3.7	3.9	4.0	3.9	4.1	AMaLGaM IDEA [4]
BayEDAcG	**1.4**	**2.4**	52	139	573	949	*11e-1/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.3**	4.3	3.2	5.4	5.7	5.9	6.4	6.1	6.6	7.0	BIPOP-CMA-ES [15]
BFGS	**1.2**	5.0	6.8	15	45	74	165	664	581	*67e-5/5e3*	BFGS [30]
Cauchy EDA	4.1	15	7.3	7.7	7.7	8.2	8.5	8.6	8.5	8.5	Cauchy EDA [24]
(1+1)-CMA-ES	**1.1**	4.4	5.2	7.3	7.0	7.3	8.1	7.6	7.9	7.6	(1+1)-CMA-ES [2]
DASA	13	90	536	855	2561	4866	16292	46654	1.44e5	*62e-5/1e6*	DASA [19]
DEPSO	**1.1**	6.1	8.4	25	63	125	*18e-3/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.5**	4.2	5.1	8.7	24	49	74	121	DIRECT [25]
EDA-PSO	**1.4**	3.5	6.4	42	180	274	710	3977	31188	*27e-5/1e5*	EDA-PSO [6]
full NEWUOA	**1.5**	5.2	8.5	12	31	76	140	293	758	1845	full NEWUOA [31]
G3-PCX	**1.2**	3.9	13	30	36	47	50	55	70	61	G3-PCX [26]
simple GA	**1.3**	3.7	25	173	1090	22373	*25e-3/1e5*	.	.	.	simple GA [22]
GLOBAL	**1.3**	**2.8**	9.2	9.3	7.3	6.0	13	*67e-5/400*	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	3.3	**2.6**	**3.1**	**3.6**	**3.3**	**3.6**	**3.6**	**3.6**	**3.7**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.1**	3.7	13	20	18	15	14	14	13	11	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	16	52	112	167	474	849	*13e-3/1e4*	.	.	LSfminbnd [28]
LSstep	28	419	284	573	1041	1508	*35e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	3.3	8.7	17	18	21	23	21	19	22	MA-LS-Chain [21]
MCS	**1**	4.7	23	20	165	958	2161	2533	*75e-4/3e4*	.	MCS [18]
NELDER (Han)	**1.7**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1.3**	**2.2**	**1.1**	**1.1**	**1.0**	**1.0**	**1.0**	**1.0**	**1.1**	**1.0**	NELDER (Doe) [5]
NEWUOA	**1.6**	**2.8**	6.3	10	22	25	72	62	91	147	NEWUOA [31]
(1+1)-ES	**1.9**	31	37	94	208	371	795	4207	8102	37041	(1+1)-ES [1]
POEMS	171	110	48	93	142	330	1100	2267	6252	23556	POEMS [20]
PSO	**1.6**	3.3	9.0	27	76	142	327	1087	2899	10921	PSO [7]
PSO_Bounds	**1.1**	3.8	9.2	43	122	260	621	1244	2987	*93e-7/1e5*	PSO_Bounds [8]
Monte Carlo	**1.6**	5.4	18	279	11643	1.12e5	*32e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	3.2	4.8	5.6	7.0	7.5	18	28	43	70	168	Rosenbrock [27]
VNS (Garcia)	**1.4**	3.9	8.8	10	10	8.8	9.2	9.1	8.6	8.4	VNS (Garcia) [11]

Table 14: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{14} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	0.70	3.7	8.1	12	19	28	34	45	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	**1.6**	**2.4**	14	60	75	83	131	528	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.2**	**1.6**	3.3	3.9	4.7	4.2	3.9	3.8	4.2	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.9**	**1.8**	10	25	67	98	181	*12e-5/2e3*	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.1**	**1.9**	**2.5**	3.0	4.2	4.6	5.3	5.5	7.1	BIPOP-CMA-ES [15]
BFGS	**1**	**1.4**	**2.1**	**2.8**	**1.8**	**1.7**	**1.4**	**1.1**	**1.0**	6.0	BFGS [30]
Cauchy EDA	**1**	4.6	13	13	12	11	10	8.6	8.9	8.5	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.4**	**1.7**	3.1	3.4	3.6	4.0	3.9	4.4	4.7	(1+1)-CMA-ES [2]
DASA	**1**	18	22	22	16	18	33	592	9261	3.11e5	DASA [19]
DEPSO	**1**	**1**	**1.4**	5.2	10	16	17	18	55	*17e-7/2e3*	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1.3**	**2.1**	**2.8**	6.0	8.6	12	32	DIRECT [25]
EDA-PSO	**1**	**1.2**	**1.4**	**2.9**	8.2	12	15	74	157	1077	EDA-PSO [6]
full NEWUOA	**1**	**1.4**	3.2	**1.4**	**1**	**1**	**1**	**1.1**	**1.5**	3.7	full NEWUOA [31]
G3-PCX	**1**	**1.2**	**1.8**	6.3	6.3	5.9	6.6	7.6	9.1	11	G3-PCX [26]
simple GA	**1**	**1.1**	**1.0**	4.0	41	199	276	630	3161	*58e-7/1e5*	simple GA [22]
GLOBAL	**1**	**1.1**	**1.7**	5.5	13	13	8.8	6.2	8.2	*34e-7/300*	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.5**	**1.6**	3.7	3.9	4.0	3.9	3.4	3.5	3.6	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.2**	**1.6**	**1.8**	4.4	4.9	7.4	10	10	11	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.3**	4.7	5.4	**3.0**	6.2	76	1501	*23e-5/1e4*	.	LSfminbnd [28]
LSstep	**1**	55	40	73	50	124	1561	5059	*23e-4/1e4*	.	LSstep [28]
MA-LS-Chain	**1**	**1.3**	**1.7**	3.1	10	15	13	12	12	17	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1.4**	**1.7**	**2.8**	3.1	23	8174	MCS [18]
NELDER (Han)	**1**	**1.5**	**2.1**	**1.4**	**1.4**	**1.4**	**1.2**	**1.0**	**1.0**	**1.1**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**1.3**	**1.4**	**1.3**	**1.3**	**1.1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	3.7	**2.4**	**1.6**	**1.5**	**1.6**	**1.8**	**2.1**	5.4	NEWUOA [31]
(1+1)-ES	**1**	**1.7**	**2.3**	**2.5**	**2.5**	3.4	9.2	156	3405	*22e-7/1e6*	(1+1)-ES [1]
POEMS	**1**	136	192	86	73	155	178	184	335	3279	POEMS [20]
PSO	**1**	**1.1**	**1.4**	4.8	13	25	36	48	85	1732	PSO [7]
PSO_Bounds	**1**	**1.1**	**1.5**	**2.7**	14	45	72	114	181	1178	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.8**	**2.6**	31	556	7246	1.08e5	4.17e5	*15e-5/1e6*	Monte Carlo [3]
Rosenbrock	**1**	**2.2**	4.0	**1.9**	**1.6**	**1.6**	**1.9**	**1.8**	**2.4**	**3.0**	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.1**	6.2	10	9.4	9.0	8.1	8.6	9.3	VNS (Garcia) [11]

Table 15: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{15} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.60	19	146	517	533	556	582	616	706	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.1**	**1.6**	**2.7**	6.8	3.4	4.8	5.7	7.1	7.9	9.1	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	**2.8**	**1.1**	4.3	**2.7**	**2.8**	**2.8**	**2.7**	**2.6**	**2.3**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**2.2**	**2.1**	8.2	7.6	26	*16e-2/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.2**	**2.9**	**1.1**	**1.8**	**2.1**	**2.2**	**2.2**	**2.1**	**2.1**	**1.9**	BIPOP-CMA-ES [15]
BFGS	**1.2**	17	4.2	4.6	7.9	7.7	7.3	7.0	6.6	5.8	BFGS [30]
Cauchy EDA	9.1	38	4.9	**2.9**	3.2	11	14	14	13	12	Cauchy EDA [24]
(1+1)-CMA-ES	**1.2**	**2.8**	22	7.7	7.6	7.4	7.1	6.8	6.5	5.7	(1+1)-CMA-ES [2]
DASA	4.6	22	64	84	64	62	60	57	54	48	DASA [19]
DEPSO	**1.1**	**1.6**	**2.9**	3.8	**1.7**	**2.2**	**2.5**	**2.6**	3.0	6.3	DEPSO [12]
DIRECT	**1**	**1**	**1.0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	DIRECT [25]
EDA-PSO	**1**	3.3	**2.0**	9.3	6.1	8.3	8.3	8.5	8.4	8.1	EDA-PSO [6]
full NEWUOA	**1.2**	3.1	**1.5**	**1.4**	3.5	3.4	3.3	3.1	**3.0**	**2.6**	full NEWUOA [31]
G3-PCX	**1.1**	**2.3**	7.8	13	22	21	20	19	18	16	G3-PCX [26]
simple GA	**1.2**	**2.3**	4.2	18	13	34	96	98	102	123	simple GA [22]
GLOBAL	**1.1**	**2.6**	**3.0**	**1.6**	**2.6**	**2.5**	**2.4**	**2.3**	**2.2**	**2.0**	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**2.5**	**1**	4.2	5.1	5.1	5.0	4.8	4.6	4.1	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	3.8	**1.5**	**2.9**	**2.1**	**2.2**	**2.2**	**2.1**	**2.1**	**1.9**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1.1**	6.2	3.7	20	36	51	66	207	*71e-2/9e3*	.	LSfminbnd [28]
LSstep	**1.1**	47	171	196	80	79	77	74	71	63	LSstep [28]
MA-LS-Chain	**1.1**	**2.0**	**1.7**	**1.9**	**1.6**	**1.5**	**1.5**	**1.5**	**1.4**	**1.3**	MA-LS-Chain [21]
MCS	**1**	**1**	**2.1**	3.5	**1.4**	**1.4**	**1.3**	**1.3**	**1.2**	**1.1**	MCS [18]
NELDER (Han)	**1**	**1.9**	8.4	7.3	10	9.4	9.0	8.6	8.2	7.1	NELDER (Han) [16]
NELDER (Doe)	**1**	3.2	**1.1**	**1.3**	**1.4**	**1.3**	**1.3**	**1.2**	**1.2**	**1.0**	NELDER (Doe) [5]
NEWUOA	**1.1**	11	4.1	3.4	3.3	3.2	3.0	**2.9**	**2.7**	**2.4**	NEWUOA [31]
(1+1)-ES	**1.4**	3.7	**1.1**	5.3	8.4	8.2	7.9	7.5	7.1	6.3	(1+1)-ES [1]
POEMS	28	116	16	19	18	20	21	21	22	22	POEMS [20]
PSO	**1.1**	**2.4**	**1.9**	4.1	16	16	16	16	16	15	PSO [7]
PSO_Bounds	**1.2**	**2.3**	**1.7**	6.6	3.9	7.3	9.2	11	11	12	PSO_Bounds [8]
Monte Carlo	**1.1**	**2.1**	**2.4**	64	148	1467	5753	12221	*50e-4/1e6*	.	Monte Carlo [3]
Rosenbrock	**1.3**	19	15	10	10	9.2	8.9	8.5	8.0	7.0	Rosenbrock [27]
VNS (Garcia)	**1**	3.3	3.4	**1.9**	**2.4**	**2.4**	**2.3**	**2.4**	**2.7**	3.7	VNS (Garcia) [11]

Table 16: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_{16} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.50	0.57	4.6	25	87	163	179	195	205	269	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	**1.3**	**2.7**	5.6	9.1	14	19	25	34	37	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.2**	3.2	**3.4**	5.1	4.6	4.5	4.2	4.1	3.3	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.4**	**1.5**	10	24	39	76	71	68	108	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	3.1	3.5	3.5	**2.5**	**2.4**	**2.3**	**2.3**	**1.9**	BIPOP-CMA-ES [15]
BFGS	**1**	11	40	147	173	269	*27e-2/6e3*	.	.	.	BFGS [30]
Cauchy EDA	**1**	4.2	4.5	4.4	6.1	15	29	31	35	27	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.2**	6.0	**2.3**	**2.3**	5.2	8.8	12	11	12	(1+1)-CMA-ES [2]
DASA	**1**	9.0	29	152	183	131	205	254	335	529	DASA [19]
DEPSO	**1**	**1.5**	3.9	10	10	10	26	38	72	*16e-4/2e3*	DEPSO [12]
DIRECT	**1**	**1.4**	**1.6**	**1**	**1**	**1**	**1**	**1.5**	**2.0**	**1.9**	DIRECT [25]
EDA-PSO	**1**	**1.8**	**2.6**	4.8	15	195	291	371	408	315	EDA-PSO [6]
full NEWUOA	**1**	**2.5**	8.1	5.9	3.9	3.2	5.5	7.6	10	16	full NEWUOA [31]
G3-PCX	**1**	**1.4**	**2.8**	8.9	3.1	4.5	4.8	5.0	5.3	11	G3-PCX [26]
simple GA	**1**	**1.2**	**2.0**	4.1	16	42	178	445	686	693	simple GA [22]
GLOBAL	**1**	**1.7**	3.9	5.1	**2.4**	**1.4**	**1.5**	**1.4**	**1.7**	**1.5**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	**1**	6.9	7.4	9.1	9.2	8.6	8.3	7.0	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.8**	3.2	4.1	**2.4**	**2.9**	4.0	3.8	3.9	3.3	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	3.6	5.6	5.7	5.4	8.3	14	33	38	107	LSfminbnd [28]
LSstep	**1**	**1.5**	**1.6**	11	23	63	70	155	199	152	LSstep [28]
MA-LS-Chain	**1**	**1.2**	**1.3**	3.6	4.2	6.4	10	11	10	8.3	MA-LS-Chain [21]
MCS	**1**	**1.1**	5.1	6.7	**2.7**	4.3	6.8	10	29	115	MCS [18]
NELDER (Han)	**1**	**1.3**	**1.2**	7.6	4.4	4.7	4.3	4.0	3.8	**2.9**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**1.6**	3.5	**1.8**	**1.1**	**1.1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1**	**2.4**	9.0	10	6.8	6.9	22	37	44	77	NEWUOA [31]
(1+1)-ES	**1**	**1.7**	35	38	35	33	56	73	84	122	(1+1)-ES [1]
POEMS	**1**	98	71	648	201	113	112	107	107	88	POEMS [20]
PSO	**1**	**1.7**	**2.5**	3.8	6.1	101	94	88	86	69	PSO [7]
PSO_Bounds	**1**	**1.2**	**2.8**	6.4	11	113	123	121	121	103	PSO_Bounds [8]
Monte Carlo	**1**	**1.2**	**2.3**	5.0	20	137	1202	24254	71559	*18e-5/1e6*	Monte Carlo [3]
Rosenbrock	**1**	10	33	36	33	27	79	295	*19e-4/8e3*	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.2**	4.6	5.0	4.8	4.9	4.7	4.7	5.6	6.8	VNS (Garcia) [11]

Table 17: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{17} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	1.3	30	66	138	198	372	543	828	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.2**	**1.5**	**2.8**	16	15	17	12	12	11	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.5**	**1.5**	**1.3**	4.8	**2.7**	4.5	3.3	**2.9**	**2.1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	**1**	**2.0**	8.0	7.0	8.7	8.8	27	*87e-6/2e3*	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.2**	4.1	**1.8**	**1.5**	**1**	**1**	**1**	**1.3**	**1.1**	BIPOP-CMA-ES [15]
BFGS	**1**	6.4	15	16	90	*24e-2/2e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	7.9	18	120	56	28	20	11	16	13	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	12	3.1	5.9	14	14	14	16	10	(1+1)-CMA-ES [2]
DASA	**1**	**1**	21	29	37	52	93	226	337	221	DASA [19]
DEPSO	**1**	**1.3**	**2.7**	**1.1**	4.3	3.7	3.7	**2.8**	**2.4**	**2.8**	DEPSO [12]
DIRECT	**1**	**1**	**1.4**	**1**	**1**	**1.0**	**1.4**	**1.2**	**1**	**1**	DIRECT [25]
EDA-PSO	**1.1**	**1.1**	**2.6**	**2.0**	3.9	7.4	10	8.2	8.0	7.1	EDA-PSO [6]
full NEWUOA	**1**	**1.4**	8.2	4.4	14	21	53	48	*30e-4/6e3*	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	**2.5**	4.5	6.2	3.9	3.2	**2.6**	4.4	**3.0**	G3-PCX [26]
simple GA	**1**	**1.2**	**2.1**	5.1	47	61	91	119	151	*69e-8/1e5*	simple GA [22]
GLOBAL	**1**	**1.2**	**2.6**	4.0	4.1	3.9	4.4	10	*75e-4/500*	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	**1.3**	8.8	6.2	4.2	5.1	4.2	4.0	**2.8**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.9**	4.0	**2.2**	**2.8**	**2.3**	**1.8**	**1.6**	**1.5**	**1.4**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.2**	5.4	**1.2**	7.3	55	*16e-3/5e3*	.	.	.	LSfminbnd [28]
LSstep	**1.1**	**2.0**	42	40	35	44	82	391	*10e-4/1e4*	.	LSstep [28]
MA-LS-Chain	**1.1**	**1.3**	**1.3**	**2.2**	5.3	4.3	4.8	**2.8**	3.1	**2.9**	MA-LS-Chain [21]
MCS	**1**	**1**	**1.3**	4.3	4.8	5.4	9.2	44	142	125	MCS [18]
NELDER (Han)	**1**	**1.5**	135	28	20	14	11	12	10	6.3	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.5**	**1.4**	**1.5**	3.3	**3.0**	3.1	7.0	5.9	4.0	NELDER (Doe) [5]
NEWUOA	**1**	**1.9**	7.7	6.8	18	33	115	*75e-4/5e3*	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.1**	**2.7**	5.9	6.7	4.8	8.5	13	23	15	(1+1)-ES [1]
POEMS	4.5	108	109	18	35	31	32	23	24	21	POEMS [20]
PSO	**1.1**	**1.2**	**1.9**	**1.6**	5.0	6.2	8.1	6.2	5.5	5.5	PSO [7]
PSO_Bounds	**1**	**1.3**	**1.9**	**1.3**	13	15	22	15	21	30	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	**1.7**	5.2	215	4884	74385	*73e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	20	45	83	141	502	349	*24e-2/5e3*	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.5**	5.7	4.7	**2.7**	**2.9**	**2.6**	6.7	32	VNS (Garcia) [11]

Table 18: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{18} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	1.6	10	67	333	625	854	1036	1219	1429	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.1**	**1.3**	**1.6**	6.6	5.5	5.4	6.7	8.1	10	13	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	**1.3**	**1.3**	4.1	**1**	**1**	**1.1**	**1.2**	**1.1**	**1.1**	AMaLGaM IDEA [4]
BayEDAcG	**1.4**	**1.5**	**2.3**	19	19	48	*53e-2/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.6**	**2.4**	**2.2**	6.5	**1.9**	**1.1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	5.4	11	14	30	108	*74e-2/2e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**2.6**	2241	380	55	11	6.4	5.0	7.0	7.4	6.7	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	22	6.6	13	17	38	83	143	*32e-3/1e4*	.	(1+1)-CMA-ES [2]
DASA	3.3	27	26	91	86	739	1784	4171	5876	5013	DASA [19]
DEPSO	**1.3**	**1**	**2.7**	3.1	**2.1**	3.3	11	9.4	8.3	*75e-4/2e3*	DEPSO [12]
DIRECT	**1.4**	**1.9**	**1**	**1**	**1.1**	**1.2**	3.4	4.8	4.9	11	DIRECT [25]
EDA-PSO	**1.3**	**1.3**	**2.4**	5.4	7.1	9.1	11	12	13	15	EDA-PSO [6]
full NEWUOA	**1.2**	5.0	**3.0**	16	19	71	*58e-3/6e3*	.	.	.	full NEWUOA [31]
G3-PCX	**1.9**	**1.1**	**2.0**	10	21	41	48	72	99	85	G3-PCX [26]
simple GA	**1.1**	**1.5**	4.3	15	23	107	275	677	1236	*24e-4/1e5*	simple GA [22]
GLOBAL	**1.3**	**1.2**	**2.0**	3.1	**2.2**	4.8	7.6	*58e-3/1e3*	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	**1.8**	**1.4**	12	**2.9**	**1.8**	**2.3**	**2.0**	**2.0**	**1.8**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.5**	4.9	**2.1**	6.2	**2.1**	**1.3**	**1.1**	**1.0**	**1.1**	**1.1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.1**	3.6	**1.3**	**2.1**	7.0	33	*58e-3/4e3*	.	.	.	LSfminbnd [28]
LSstep	28	18	12	79	60	115	*24e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1.7**	**1.5**	**1.6**	3.2	**2.5**	3.2	4.0	3.9	5.8	7.0	MA-LS-Chain [21]
MCS	**1.4**	**3.0**	**1.3**	**2.8**	**1.7**	8.4	135	352	*30e-4/3e4*	.	MCS [18]
NELDER (Han)	**1.2**	**1.3**	21	44	18	20	38	47	40	34	NELDER (Han) [16]
NELDER (Doe)	**1.3**	**1.3**	**1.2**	3.1	**2.4**	4.3	5.8	8.7	25	21	NELDER (Doe) [5]
NEWUOA	**1.3**	13	5.6	12	14	62	*98e-3/6e3*	.	.	.	NEWUOA [31]
(1+1)-ES	**1.5**	**2.4**	63	232	618	1493	4935	13970	*75e-4/1e6*	.	(1+1)-ES [1]
POEMS	101	72	28	118	29	28	23	31	45	42	POEMS [20]
PSO	**1.3**	**1.3**	**1.7**	3.4	**2.8**	3.2	3.5	5.6	6.5	7.2	PSO [7]
PSO_Bounds	**1.4**	**1.5**	**1.5**	5.3	6.7	8.8	10	12	17	23	PSO_Bounds [8]
Monte Carlo	**1.1**	**1.2**	**2.2**	21	273	10610	*24e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	26	54	61	56	201	*53e-2/5e3*	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.6**	3.8	16	5.4	3.6	4.8	8.1	18	151	VNS (Garcia) [11]

Table 19: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{19} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	0.50	0.50	13	108	114	120	126	138	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.1**	5.5	55	17	12	22	30	41	54	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	6.3	40	**6.2**	18	18	17	17	16	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	3.9	44	10	13	57	*35e-4/2e3*	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	6.0	31	10	12	12	15	14	14	BIPOP-CMA-ES [15]
BFGS	**1**	11	37	311	61	30	29	27	26	24	BFGS [30]
Cauchy EDA	**1**	**1.1**	16	115	51	170	857	1323	2832	*18e-4/5e4*	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	5.6	87	33	32	31	29	28	26	(1+1)-CMA-ES [2]
DASA	**1**	7.5	42	756	97	252	251	252	257	270	DASA [19]
DEPSO	**1**	**1**	4.4	59	17	18	35	36	69	67	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**4.6**	10	10	9.1	**8.9**	59	DIRECT [25]
EDA-PSO	**1**	**1.1**	5.2	37	13	17	30	57	62	72	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	6.7	88	17	17	17	16	15	14	full NEWUOA [31]
G3-PCX	**1**	**1**	5.3	52	37	49	47	45	43	40	G3-PCX [26]
simple GA	**1**	**1.2**	4.5	51	20	21	108	363	643	4862	simple GA [22]
GLOBAL	**1**	**1.3**	4.3	50	9.4	11	10	10	10	**8.8**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	5.5	**25**	63	50	48	48	46	42	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.5**	4.3	29	6.8	19	20	19	19	18	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.1**	9.4	49	10	29	70	116	307	*59e-5/5e3*	LSfminbnd [28]
LSstep	**1**	**1.9**	139	442	27	63	137	581	*11e-4/1e4*	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	6.7	60	7.2	15	15	14	14	13	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1**	**1**	3.1	383	64	32	30	29	27	25	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	4.6	52	10	**8.1**	**7.8**	**7.4**	**7.1**	**6.5**	NELDER (Doe) [5]
NEWUOA	**1**	**1.5**	6.2	126	16	27	26	25	24	22	NEWUOA [31]
(1+1)-ES	**1**	**1.6**	6.2	103	22	23	25	27	30	38	(1+1)-ES [1]
POEMS	**1**	128	343	555	57	207	204	199	194	187	POEMS [20]
PSO	**1**	**1.1**	5.3	34	9.1	**4.7**	**6.0**	**8.7**	10	16	PSO [7]
PSO_Bounds	**1**	**1.5**	5.1	40	7.8	11	20	36	47	71	PSO_Bounds [8]
Monte Carlo	**1**	**1.2**	4.5	64	16	36	114	305	724	31564	Monte Carlo [3]
Rosenbrock	**1**	6.9	42	164	34	30	29	28	26	24	Rosenbrock [27]
VNS (Garcia)	**1**	**1.2**	**2.2**	43	12	19	19	20	20	21	VNS (Garcia) [11]

Table 20: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{20} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.1	1.6	1.9	30	182	183	183	184	185	188	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**2.1**	**2.8**	3.1	14	6.2	9.2	12	16	20	26	ALPS-GA [17]
AMaLGaM IDEA	**2.2**	**2.5**	**2.6**	26	37	38	38	38	38	38	AMaLGaM IDEA [4]
BayEDAcG	3.2	4.0	3.6	9.2	32	*25e-2/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.9**	**2.8**	**2.7**	13	10	10	11	11	11	11	BIPOP-CMA-ES [15]
BFGS	**2.5**	**2.2**	**2.1**	6.0	**2.7**	**2.7**	**2.7**	**2.7**	**2.7**	**2.6**	BFGS [30]
Cauchy EDA	26	20	18	10	31	153	1263	1987	1969	1944	Cauchy EDA [24]
(1+1)-CMA-ES	**2.2**	**2.0**	**2.1**	7.5	8.5	8.6	8.6	8.6	8.6	8.6	(1+1)-CMA-ES [2]
DASA	59	52	49	81	44	45	45	45	45	45	DASA [19]
DEPSO	**1.4**	**1**	**1**	10	4.9	5.6	6.4	6.8	8.0	9.2	DEPSO [12]
DIRECT	5.7	5.9	6.1	**1**	**2.9**	3.0	3.1	3.3	3.7	3.9	DIRECT [25]
EDA-PSO	**1.7**	3.3	3.2	9.0	13	21	25	25	26	27	EDA-PSO [6]
full NEWUOA	**2.9**	**2.1**	**1.8**	18	8.3	8.3	8.3	8.3	8.2	8.1	full NEWUOA [31]
G3-PCX	**2.9**	**2.8**	**2.9**	38	7.8	7.8	8.0	8.1	8.1	8.2	G3-PCX [26]
simple GA	**2.7**	**2.4**	**2.8**	14	15	27	45	65	85	126	simple GA [22]
GLOBAL	**1.8**	**1.9**	**2.4**	11	4.5	4.5	4.5	4.5	4.5	4.5	GLOBAL [23]
iAMaLGaM IDEA	**2.1**	**2.4**	**2.2**	51	26	26	27	27	27	27	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.6**	**1.8**	**1.8**	9.4	15	16	17	18	18	18	IPOP-SEP-CMA-ES [29]
LSfminbnd	6.5	6.7	6.6	154	*68e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	94	207	178	119	25	27	30	37	40	50	LSstep [28]
MA-LS-Chain	**1.5**	**1.9**	**2.4**	4.2	**1.8**	**2.0**	**2.1**	**2.2**	**2.3**	**2.4**	MA-LS-Chain [21]
MCS	**2.9**	6.2	5.7	**2.2**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1.5**	**1.3**	**1.3**	36	28	28	28	28	28	27	NELDER (Han) [16]
NELDER (Doe)	**1.6**	**1.7**	**1.5**	**3.9**	**2.8**	**2.8**	**2.9**	**2.9**	**2.9**	**2.9**	NELDER (Doe) [5]
NEWUOA	**3.0**	**2.2**	**2.1**	7.0	5.9	5.9	5.9	5.9	5.8	5.8	NEWUOA [31]
(1+1)-ES	4.1	3.7	3.3	13	9.0	9.1	9.2	9.2	9.2	9.2	(1+1)-ES [1]
POEMS	191	140	126	25	30	35	42	46	52	61	POEMS [20]
PSO	**2.5**	**2.2**	**2.5**	8.3	5.0	6.3	8.7	10	12	15	PSO [7]
PSO_Bounds	**2.5**	**2.9**	3.7	11	6.0	13	20	25	30	36	PSO_Bounds [8]
Monte Carlo	**2.2**	**2.8**	3.6	21	67	682	5771	81653	*80e-5/1e6*	.	Monte Carlo [3]
Rosenbrock	5.0	4.0	4.0	6.8	4.1	4.2	4.2	4.2	4.2	4.2	Rosenbrock [27]
VNS (Garcia)	**1**	3.8	4.3	18	9.3	10	10	10	10	13	VNS (Garcia) [11]

Table 21: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{21} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	0.83	25	87	138	145	153	162	165	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	**1.2**	**2.2**	**1.8**	**2.6**	4.9	6.4	7.8	12	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.3**	28	17	11	11	10	10	10	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.7**	**1.6**	9.3	14	39	57	86	85	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.4**	11	10	8.2	10	9.3	8.9	8.9	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	**2.6**	4.8	3.0	**2.0**	**1.9**	**1.8**	**1.7**	**1.8**	BFGS [30]
Cauchy EDA	**1**	**1**	6.0	311	93	62	65	62	81	80	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	**1.2**	12	10	6.1	5.9	5.6	5.3	5.3	(1+1)-CMA-ES [2]
DASA	**1**	**1**	13	155	139	88	84	80	77	76	DASA [19]
DEPSO	**1**	**1**	**2.1**	**2.5**	**1.5**	**1.8**	**2.4**	**2.6**	**2.9**	5.6	DEPSO [12]
DIRECT	**1**	**1**	**1.3**	**1**	**1**	**1**	**1**	**2.0**	**2.0**	**2.3**	DIRECT [25]
EDA-PSO	**1**	**1**	**1**	**1.8**	83	54	53	52	51	52	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.2**	3.6	**3.0**	**1.9**	**1.8**	**1.7**	**1.7**	**1.7**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.4**	**2.7**	**2.9**	**1.9**	**1.9**	**1.8**	**1.8**	**1.8**	G3-PCX [26]
simple GA	**1**	**1**	**1.4**	**1.0**	**1.7**	4.1	7.7	18	117	271	simple GA [22]
GLOBAL	**1**	**1**	**1.5**	**1.1**	**1.1**	**1.0**	**1.0**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.6**	21	12	7.9	7.8	7.5	7.2	7.1	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1.3**	10	6.4	6.3	8.5	8.7	8.6	9.2	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	**2.1**	39	20	26	46	60	73	169	LSfminbnd [28]
LSstep	**1**	**1**	18	375	148	100	101	104	121	190	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.4**	**1.1**	**1.5**	**1.5**	**1.7**	**1.9**	**1.9**	**2.0**	MA-LS-Chain [21]
MCS	**1**	**1**	**1.6**	22	14	8.8	8.4	8.0	7.6	7.5	MCS [18]
NELDER (Han)	**1**	**1**	**1.8**	19	20	13	12	12	11	11	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.4**	**2.6**	**2.6**	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	3.5	3.9	4.0	**2.5**	**2.4**	**2.3**	**2.2**	**2.3**	NEWUOA [31]
(1+1)-ES	**1**	**1**	**2.8**	14	19	12	11	11	10	10	(1+1)-ES [1]
POEMS	**1**	**1**	129	93	890	564	543	516	493	487	POEMS [20]
PSO	**1**	**1**	**1.2**	**1.4**	83	53	51	48	46	47	PSO [7]
PSO_Bounds	**1**	**1**	**1.5**	33	299	189	181	174	167	167	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.0**	**1.8**	**1.2**	3.5	8.8	28	42	640	Monte Carlo [3]
Rosenbrock	**1**	**1**	**2.3**	5.5	3.9	**2.5**	**2.4**	**2.3**	**2.2**	**2.1**	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**1.1**	6.1	14	9.1	8.8	8.5	8.4	8.4	VNS (Garcia) [11]

Table 22: Running time excess ERT/ERT$_{\text{best}}$ on f_{22} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.50	0.50	2.5	13	84	109	125	142	144	153	ERT$_{\text{best}}$/D
ALPS-GA	**1**	**1**	**1.2**	**1.3**	**1.0**	**3.0**	5.2	7.1	9.2	15	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.3**	51	18	19	17	15	15	15	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.3**	3.3	7.6	11	34	59	197	*37e-4 /2e3*	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.0**	7.3	11	8.7	10	9.2	9.1	8.7	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	5.4	5.0	**1.5**	**1.2**	**1.1**	**1.0**	**1**	**1**	BFGS [30]
Cauchy EDA	**1**	**1**	27	607	191	269	393	445	538	509	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	14	26	7.2	5.7	5.0	4.5	4.4	4.3	(1+1)-CMA-ES [2]
DASA	**1**	**1**	11	80	22	21	22	28	40	63	DASA [19]
DEPSO	**1**	**1**	**2.3**	4.7	**2.4**	4.0	4.6	5.0	6.6	10	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	**2.1**	**1.3**	**1.3**	**1.4**	**2.2**	4.8	5.1	DIRECT [25]
EDA-PSO	**1**	**1**	**1.1**	4.0	**1.7**	4.2	4.9	8.4	11	25	EDA-PSO [6]
full NEWUOA	**1**	**1**	6.5	6.8	**1.5**	**1.2**	**1.1**	**1.1**	**1.1**	**1.2**	full NEWUOA [31]
G3-PCX	**1**	**1**	**2.1**	**2.2**	**1.1**	**1.1**	**1.1**	**1.3**	**1.4**	**1.6**	G3-PCX [26]
simple GA	**1**	**1**	**1.2**	**3.0**	**1.3**	3.3	7.1	17	281	1855	simple GA [22]
GLOBAL	**1**	**1**	**1.7**	**2.9**	**1.3**	**1.5**	**1.5**	**1.3**	**1.4**	**1.3**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.5**	14	10	8.9	8.0	7.2	7.1	7.3	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1**	7.7	4.4	4.1	3.9	3.6	3.8	3.8	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	**1.4**	4.7	5.1	53	49	61	69	464	LSfminbnd [28]
LSstep	**1**	**1**	**1.0**	80	137	138	148	282	969	916	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.0**	**2.8**	**1.6**	**1.9**	**2.2**	**2.3**	**2.4**	**2.4**	MA-LS-Chain [21]
MCS	**1**	**1**	**2.4**	40	7.4	6.0	5.3	4.7	4.8	5.2	MCS [18]
NELDER (Han)	**1**	**1**	7.7	39	10	7.6	6.6	5.9	5.8	5.5	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.3**	8.1	**1.8**	**1.4**	**1.2**	**1.1**	**1.1**	**1.1**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.9**	6.3	**1.2**	**1**	**1**	**1**	**1.0**	**1.1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	**1.6**	46	11	10	9.4	9.4	10	12	(1+1)-ES [1]
POEMS	**1**	**1**	64	935	233	186	165	147	149	145	POEMS [20]
PSO	**1**	**1**	**1.5**	**2.7**	**1**	**1.8**	**1.9**	**2.3**	3.8	6.5	PSO [7]
PSO_Bounds	**1**	**1**	**1.2**	536	87	67	60	56	58	64	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.3**	**2.8**	**1.5**	3.1	7.2	24	93	758	Monte Carlo [3]
Rosenbrock	**1**	**1**	12	17	4.5	3.5	3.1	**2.7**	**2.7**	**2.6**	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.0**	**1**	**2.8**	3.8	4.8	4.7	5.0	5.3	VNS (Garcia) [11]

Table 23: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	3.9	96	117	131	150	157	174	190	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	**1.4**	14	86	136	196	642	4063	28212	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.3**	7.5	10	10	9.0	8.9	8.4	8.1	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**2.0**	11	*56e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.8**	8.3	15	14	13	13	12	12	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	4.8	4.9	28	121	476	455	410	*73e-3/5e3*	BFGS [30]
Cauchy EDA	**1**	**1**	**1.8**	16	861	*14e-2/5e4*	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	**2.1**	5.1	8.4	8.6	7.7	7.6	6.9	6.6	(1+1)-CMA-ES [2]
DASA	**1**	**1**	5.7	17	174	1780	8564	9614	8664	7940	DASA [19]
DEPSO	**1**	**1**	**2.2**	24	*96e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	4.2	294	266	238	231	210	198	DIRECT [25]
EDA-PSO	**1**	**1**	**2.3**	18	1422	*13e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	6.0	**1.5**	24	46	81	79	71	65	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.9**	**1.6**	6.1	6.0	5.8	5.8	5.5	7.4	G3-PCX [26]
simple GA	**1**	**1**	**1.4**	6.6	328	843	3307	*41e-4/1e5*	.	.	simple GA [22]
GLOBAL	**1**	**1**	**1**	**2.6**	97	*21e-2/2e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.3**	5.3	**5.5**	**5.3**	**4.9**	**5.0**	**4.7**	**4.6**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**2.6**	8.1	14	16	14	14	13	12	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	**1.3**	**2.1**	30	118	197	189	*25e-3/7e3*	.	LSfminbnd [28]
LSstep	**1**	**1**	**2.6**	18	1282	*24e-2/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.8**	5.5	7.4	7.1	6.6	6.7	6.4	7.0	MA-LS-Chain [21]
MCS	**1**	**1**	3.4	**2.8**	6.3	23	213	496	1013	1900	MCS [18]
NELDER (Han)	**1**	**1**	**1.3**	**1.6**	**2.2**	**2.2**	**2.0**	**1.9**	**1.8**	**1.7**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	4.7	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	7.8	3.2	32	89	130	171	500	459	NEWUOA [31]
(1+1)-ES	**1**	**1**	**2.6**	3.7	19	55	237	1008	2094	6670	(1+1)-ES [1]
POEMS	**1**	**1**	14	28	187	185	181	186	181	189	POEMS [20]
PSO	**1**	**1**	**1.3**	9.0	42	59	73	79	88	95	PSO [7]
PSO_Bounds	**1**	**1**	**1.7**	9.4	258	462	500	687	659	864	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.5**	8.0	1919	*46e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**1.9**	**2.2**	10	15	17	23	29	*66e-7/5e3*	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**1.8**	8.3	38	67	65	62	56	52	VNS (Garcia) [11]

Table 24: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{24} in **2-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.50	0.50	9.1	429	4257	11700	12056	12360	12360	12360	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	**1**	6.5	4.0	**2.8**	**2.9**	**2.9**	3.0	3.2	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.2**	35	11	6.7	6.7	6.6	6.6	6.7	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.9**	68	*22e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	4.6	19	17	13	22	22	22	22	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	3.4	5.1	**2.9**	*42e-2/3e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	3.9	33	175	*49e-2/5e4*	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	**2.7**	6.1	4.8	**2.9**	**2.8**	**2.7**	**2.7**	3.6	(1+1)-CMA-ES [2]
DASA	**1**	**1**	10	138	110	61	59	58	58	58	DASA [19]
DEPSO	**1**	**1**	3.3	67	*24e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.9**	79	8.7	5.0	4.9	4.7	4.7	4.8	DIRECT [25]
EDA-PSO	**1**	**1**	**1.6**	100	12	9.0	9.0	8.8	8.8	8.9	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.8**	**1**	**1**	**1.1**	**1.0**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.2**	37	20	*10e-2/5e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	**1.6**	67	*79e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**2.7**	3.3	7.0	*51e-2/2e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.4**	28	9.1	5.4	5.3	5.2	5.3	5.3	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1.7**	7.2	3.9	3.7	3.7	3.6	3.6	3.6	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	**2.8**	8.3	*37e-2/8e3*	.	.	.	.	.	LSfminbnd [28]
LSstep	3.0	3.0	4.8	29	33	12	12	*11e-1/1e4*	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**2.5**	31	34	*11e-1/1e4*	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	**2.5**	5.7	**1.6**	**2.7**	**2.7**	**2.6**	**2.6**	**2.6**	MCS [18]
NELDER (Han)	**1**	**1**	16	7.4	5.0	6.6	6.4	6.2	6.2	6.2	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.5**	**1.9**	**1.5**	3.2	3.1	3.0	3.0	3.0	NELDER (Doe) [5]
NEWUOA	**1**	**1**	3.1	**2.8**	**1.9**	**2.0**	**1.9**	**1.9**	**1.9**	**1.9**	NEWUOA [31]
(1+1)-ES	**1**	**1**	8.0	12	11	21	20	19	19	19	(1+1)-ES [1]
POEMS	**1**	**1**	28	1520	173	*20e-1/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1**	**2.4**	470	49	18	17	17	17	17	PSO [7]
PSO_Bounds	**1**	**1**	**1.3**	1523	155	57	55	54	54	54	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.5**	14	149	572	*49e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	19	35	15	11	11	11	11	11	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**1.2**	5.3	**1.7**	**1**	**1**	**1.1**	**1.9**	4.7	VNS (Garcia) [11]

Table 25: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_1 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.33	0.33	1.2	2.7	2.7	2.7	2.7	2.7	2.7	2.7	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	**1**	**2.6**	31	156	280	447	663	862	1221	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	3.1	7.4	16	26	37	45	54	73	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**2.4**	9.2	96	123	157	185	282	423	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**2.8**	5.1	11	18	23	29	34	47	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	**2.4**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	BFGS [30]
Cauchy EDA	**1**	**1.1**	40	36	58	91	114	141	163	211	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	**1.8**	5.2	8.8	12	15	19	23	30	(1+1)-CMA-ES [2]
DASA	**1**	3.1	37	37	49	63	76	89	101	129	DASA [19]
DEPSO	**1**	**1**	**2.9**	15	36	65	96	120	147	201	DEPSO [12]
DIRECT	**1**	**1**	**1.2**	**2.0**	5.7	15	27	38	52	95	DIRECT [25]
EDA-PSO	**1**	**1.1**	**2.8**	10	28	56	121	278	394	694	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	**2.9**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	full NEWUOA [31]
G3-PCX	**1**	**1.3**	**1.9**	12	15	19	24	29	34	47	G3-PCX [26]
simple GA	**1**	**1.1**	3.1	26	440	1196	2124	3154	4184	6760	simple GA [22]
GLOBAL	**1**	**1.1**	3.1	22	38	41	42	44	45	48	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	**2.4**	5.5	12	18	24	30	36	49	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	3.5	5.3	10	14	20	26	31	41	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**2.5**	5.5	4.1	5.3	5.6	5.6	5.8	5.9	5.9	LSfminbnd [28]
LSstep	**1**	**1.2**	127	94	101	101	101	101	102	102	LSstep [28]
MA-LS-Chain	**1**	**1.1**	**2.5**	14	36	57	70	75	82	96	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1.6**	**2.0**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	MCS [18]
NELDER (Han)	**1**	**1.5**	**1.9**	**1.8**	3.4	5.3	6.7	8.3	10	13	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.0**	**2.4**	3.9	5.4	6.9	8.7	10	14	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.8**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1.3**	3.4	4.1	7.0	11	14	18	22	29	(1+1)-ES [1]
POEMS	**1**	23	173	107	175	393	1016	1303	1736	2447	POEMS [20]
PSO	**1**	**1.1**	3.2	10	44	86	158	231	307	502	PSO [7]
PSO_Bounds	**1**	**1**	3.1	13	58	229	433	650	854	1464	PSO_Bounds [8]
Monte Carlo	**1**	**1**	3.8	35	1372	33018	1.28e6	*15e-4 /1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.7**	4.5	3.3	4.8	5.9	7.5	8.5	10	13	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.6**	13	24	31	37	46	50	62	VNS (Garcia) [11]

Table 26: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_2 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	6.0	11	13	14	14	15	15	15	16	16	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	43	45	66	103	135	164	190	218	246	306	ALPS-GA [17]
AMaLGaM IDEA	5.9	5.2	6.0	8.1	10	12	14	16	17	20	AMaLGaM IDEA [4]
BayEDAcG	15	14	19	26	29	46	48	55	70	93	BayEDAcG [10]
BIPOP-CMA-ES	8.9	8.7	13	17	20	21	22	22	23	24	BIPOP-CMA-ES [15]
BFGS	3.4	**2.2**	3.1	4.0	4.7	4.9	5.0	5.0	5.1	**5.2**	BFGS [30]
Cauchy EDA	15	16	18	21	25	29	34	36	40	48	Cauchy EDA [24]
(1+1)-CMA-ES	6.0	5.9	8.4	11	12	13	13	13	14	14	(1+1)-CMA-ES [2]
DASA	15	11	11	14	15	18	19	21	23	28	DASA [19]
DEPSO	18	13	15	18	24	29	33	36	40	47	DEPSO [12]
DIRECT	5.0	4.2	4.5	7.3	8.9	10	12	14	33	38	DIRECT [25]
EDA-PSO	7.8	9.2	13	31	58	84	107	133	154	201	EDA-PSO [6]
full NEWUOA	**1.0**	**1**	**1.7**	4.2	8.2	12	16	19	22	29	full NEWUOA [31]
G3-PCX	16	11	43	87	117	134	167	177	196	232	G3-PCX [26]
simple GA	70	144	280	408	573	778	953	1153	1373	1940	simple GA [22]
GLOBAL	16	10	9.0	8.9	9.0	9.3	9.4	9.4	9.5	10	GLOBAL [23]
iAMaLGaM IDEA	3.2	3.4	4.4	6.1	7.6	8.9	10	11	12	14	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	9.0	7.4	9.5	12	13	14	15	15	16	17	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1.9**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	28	16	15	14	14	14	14	13	13	13	LSstep [28]
MA-LS-Chain	12	11	14	19	22	26	30	33	38	44	MA-LS-Chain [21]
MCS	**1.9**	**1.1**	**1.8**	**1.9**	**2.2**	**3.7**	**4.4**	5.0	5.2	6.9	MCS [18]
NELDER (Han)	**2.4**	**1.8**	**2.2**	3.3	4.3	4.6	4.8	**4.9**	**5.1**	5.4	NELDER (Han) [16]
NELDER (Doe)	**1.9**	**1.7**	**2.3**	**2.8**	**3.2**	**3.6**	**3.8**	**3.9**	**4.2**	**4.6**	NELDER (Doe) [5]
NEWUOA	**1**	**1.2**	3.4	14	25	33	42	49	56	72	NEWUOA [31]
(1+1)-ES	60	249	5828	19939	41262	66346	3.18e5	4.78e5	*36e-4/1e6*	.	(1+1)-ES [1]
POEMS	275	233	284	315	364	449	501	509	621	720	POEMS [20]
PSO	20	23	46	56	65	83	95	102	121	144	PSO [7]
PSO_Bounds	16	44	147	298	343	507	559	585	642	920	PSO_Bounds [8]
Monte Carlo	66	387	6044	1.75e5	*14e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.9**	**3.0**	4.9	16	20	22	24	24	24	26	Rosenbrock [27]
VNS (Garcia)	17	15	21	26	26	27	28	29	29	30	VNS (Garcia) [11]

Table 27: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_3 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.33	0.73	13	274	277	278	281	282	282	284	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	**1.0**	25	6.2	8.9	11	13	15	17	21	ALPS-GA [17]
AMaLGaM IDEA	**1**	**2.0**	3.6	4.2	14	15	15	15	15	15	AMaLGaM IDEA [4]
BayEDAcG	**1.1**	**1.5**	32	10	*70e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	3.5	**3.2**	4.7	25	25	26	26	26	26	BIPOP-CMA-ES [15]
BFGS	**1.3**	29	42	25	155	154	153	153	152	151	BFGS [30]
Cauchy EDA	**1.1**	41	14	7.6	250	2560	*10e-2/5e4*	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.8**	8.1	4.0	38	38	37	37	37	37	(1+1)-CMA-ES [2]
DASA	**1.3**	32	14	**1.4**	12	12	12	12	12	12	DASA [19]
DEPSO	**1**	**2.4**	11	**2.7**	**4.1**	**4.8**	**5.6**	**5.9**	**7.3**	8.6	DEPSO [12]
DIRECT	**1**	**1**	4.8	4.1	17	17	17	17	17	17	DIRECT [25]
EDA-PSO	**1**	**1.6**	5.6	13	42	44	44	45	46	49	EDA-PSO [6]
full NEWUOA	**1**	4.5	4.9	3.3	15	15	15	15	15	15	full NEWUOA [31]
G3-PCX	**1.1**	**1.9**	73	58	333	331	328	327	326	324	G3-PCX [26]
simple GA	**1**	**2.2**	52	15	23	31	41	56	69	104	simple GA [22]
GLOBAL	**1.1**	**2.5**	8.2	3.6	12	12	12	12	12	12	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.9**	12	12	39	39	39	39	39	39	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**2.8**	3.4	3.7	14	17	17	17	17	17	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	6.9	**1**	38	54	54	53	53	53	52	LSfminbnd [28]
LSstep	28	148	21	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1**	**2.3**	6.7	**2.3**	8.3	8.4	8.4	8.4	8.4	**8.5**	MA-LS-Chain [21]
MCS	**1**	**1**	6.8	**1.2**	10	11	11	12	12	12	MCS [18]
NELDER (Han)	**1**	**1.8**	25	17	104	103	102	102	101	101	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.7**	**3.0**	**1.5**	8.4	8.4	8.3	**8.3**	**8.3**	**8.3**	NELDER (Doe) [5]
NEWUOA	**1**	**2.9**	5.7	5.0	55	54	54	54	53	53	NEWUOA [31]
(1+1)-ES	**1**	4.3	14	12	69	68	68	67	67	67	(1+1)-ES [1]
POEMS	16	207	26	8.2	23	27	31	35	37	45	POEMS [20]
PSO	**1**	**1.5**	7.3	3.5	**6.1**	**7.0**	7.9	8.5	10	11	PSO [7]
PSO_Bounds	**1**	**2.2**	15	8.6	18	22	25	27	29	41	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	115	5526	50784	*10e-1/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	42	41	27	409	407	403	402	401	398	Rosenbrock [27]
VNS (Garcia)	**1**	**1.7**	8.4	3.8	7.4	7.4	**7.6**	8.6	11	17	VNS (Garcia) [11]

Table 28: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_4 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	1.8	13	269	289	307	317	330	338	348	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.5**	**1.7**	37	10	**16**	**18**	**19**	21	23	**27**	ALPS-GA [17]
AMaLGaM IDEA	**1.3**	**1.2**	23	105	973	949	926	900	883	873	AMaLGaM IDEA [4]
BayEDAcG	**1.3**	**1.3**	33	*47e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.1**	**1.4**	10	263	3269	4050	3919	3772	3677	3576	BIPOP-CMA-ES [15]
BFGS	**1.8**	20	48	54	*30e-1/3e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	5.9	20	23	1323	*13e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**2.0**	**1.8**	13	21	151	142	137	132	129	125	(1+1)-CMA-ES [2]
DASA	17	29	12	**1.2**	**2.0**	**2.0**	**2.0**	**2.1**	**2.1**	**2.3**	DASA [19]
DEPSO	**2.5**	**1.5**	13	6.8	18	47	46	45	44	43	DEPSO [12]
DIRECT	**1**	**1**	**4.8**	20	26	44	83	168	182	184	DIRECT [25]
EDA-PSO	**1.5**	**1.2**	16	24	112	107	104	102	100	100	EDA-PSO [6]
full NEWUOA	**2.7**	3.5	11	25	165	155	150	145	141	137	full NEWUOA [31]
G3-PCX	**1.8**	**1.3**	126	62	430	404	391	377	367	357	G3-PCX [26]
simple GA	**1.3**	**1.4**	90	19	24	34	42	54	63	114	simple GA [22]
GLOBAL	**1.3**	**1.7**	12	7.9	51	48	46	44	43	42	GLOBAL [23]
iAMaLGaM IDEA	**1.3**	**1.6**	12	126	860	820	797	771	756	744	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.9**	6.3	83	*14e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.1**	3.4	**1**	*20e-1/4e3*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	54	70	17	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1.4**	**2.1**	10	**5.6**	60	56	55	53	52	51	MA-LS-Chain [21]
MCS	**1**	**1.2**	5.9	10	67	63	61	59	57	56	MCS [18]
NELDER (Han)	**2.3**	**1.4**	33	72	322	302	293	282	274	267	NELDER (Han) [16]
NELDER (Doe)	**1.8**	**1**	**4.5**	7.8	43	40	39	37	37	36	NELDER (Doe) [5]
NEWUOA	**2.3**	**2.2**	24	21	302	284	275	265	258	251	NEWUOA [31]
(1+1)-ES	**2.5**	**1.8**	31	33	228	214	207	200	195	189	(1+1)-ES [1]
POEMS	89	103	48	13	46	47	48	51	53	57	POEMS [20]
PSO	**1.3**	**1.3**	15	6.0	98	93	91	89	87	87	PSO [7]
PSO_Bounds	**1.5**	**1.1**	28	21	28	36	36	38	39	51	PSO_Bounds [8]
Monte Carlo	**1.3**	**1.7**	222	16250	*14e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.2**	36	43	44	139	130	126	122	118	115	Rosenbrock [27]
VNS (Garcia)	**2.2**	**1.8**	19	7.6	20	19	19	**20**	**22**	50	VNS (Garcia) [11]

Table 29: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_5 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.33	0.33	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	**1.3**	27	90	98	104	110	112	112	112	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	11	20	21	21	21	21	21	21	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.3**	22	365	368	368	368	368	368	368	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.5**	3.6	5.4	5.7	5.8	5.8	5.8	5.8	5.8	BIPOP-CMA-ES [15]
BFGS	**1**	**2.6**	**1.6**	**2.4**	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	BFGS [30]
Cauchy EDA	**1**	13	20	22	23	23	23	23	23	23	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.1**	**2.1**	**2.7**	**2.8**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	(1+1)-CMA-ES [2]
DASA	**1**	21	19	31	36	40	44	49	53	62	DASA [19]
DEPSO	**1**	**1.4**	15	35	39	39	39	39	39	39	DEPSO [12]
DIRECT	**1**	**1**	3.7	4.6	6.2	6.2	6.2	6.2	6.2	6.2	DIRECT [25]
EDA-PSO	**1**	**1.3**	8.5	16	17	17	17	17	17	17	EDA-PSO [6]
full NEWUOA	**1**	**2.0**	**1.2**	**1.7**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	full NEWUOA [31]
G3-PCX	**1**	**1.5**	9.4	22	25	25	25	25	25	25	G3-PCX [26]
simple GA	**1**	**1.2**	14	1078	3032	4842	7515	10975	15429	*22e-8/1e5*	simple GA [22]
GLOBAL	**1**	**1.3**	31	47	47	48	48	48	48	48	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	3.5	8.3	8.8	8.8	8.8	8.8	8.8	8.8	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.3**	4.1	6.7	7.0	7.1	7.1	7.1	7.1	7.1	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.1**	7.5	11	11	11	11	11	11	11	LSfminbnd [28]
LSstep	**1**	28	93	121	121	121	121	121	121	121	LSstep [28]
MA-LS-Chain	**1**	**1.3**	25	88	92	92	93	93	93	93	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1**	**1.3**	**1.6**	**2.4**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.5**	**1.4**	**2.4**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	**1.1**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	NEWUOA [31]
(1+1)-ES	**1**	**1.6**	**2.3**	**3.0**	3.1	3.1	3.1	3.1	3.1	3.1	(1+1)-ES [1]
POEMS	**1**	59	117	155	174	181	181	181	181	181	POEMS [20]
PSO	**1**	**1.1**	8.2	16	18	18	18	18	18	18	PSO [7]
PSO_Bounds	**1**	**1.3**	6.3	14	15	15	15	15	15	15	PSO_Bounds [8]
Monte Carlo	**1**	**1.2**	34	17830	6.49e6	*32e-2/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	5.0	3.3	3.6	3.6	3.6	3.6	3.6	3.6	3.6	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	18	20	20	20	20	20	20	20	VNS (Garcia) [11]

Table 30: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_6 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	1.4	2.5	11	19	30	39	50	61	72	88	$\mathrm{ERT_{best}}$/D
ALPS-GA	4.9	3.3	9.2	35	46	53	58	61	64	72	ALPS-GA [17]
AMaLGaM IDEA	4.8	4.3	3.7	5.5	5.5	6.3	6.4	6.6	6.9	7.5	AMaLGaM IDEA [4]
BayEDAcG	4.2	10	128	*66e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.6**	**1.6**	**2.4**	3.2	3.1	3.2	3.2	3.1	3.0	3.2	BIPOP-CMA-ES [15]
BFGS	3.3	**2.2**	3.5	3.4	**2.9**	**2.4**	**2.0**	**1.8**	**1.9**	3.1	BFGS [30]
Cauchy EDA	24	33	28	31	28	27	26	25	24	25	Cauchy EDA [24]
(1+1)-CMA-ES	**1.4**	**1.6**	**1.3**	**1.6**	**1.8**	**1.7**	**1.6**	**1.6**	**1.6**	**1.6**	(1+1)-CMA-ES [2]
DASA	33	58	30	32	30	36	55	56	54	66	DASA [19]
DEPSO	**2.4**	3.3	6.0	11	11	13	14	13	13	14	DEPSO [12]
DIRECT	**1.4**	**1.1**	**3.0**	33	436	1341	2713	*23e-3/3e4*	.	.	DIRECT [25]
EDA-PSO	3.9	3.4	**2.7**	13	28	42	59	62	66	76	EDA-PSO [6]
full NEWUOA	**1.5**	3.7	4.0	5.1	5.1	5.4	5.7	6.0	6.1	6.9	full NEWUOA [31]
G3-PCX	**3.0**	3.2	3.5	3.3	**2.9**	3.2	3.2	3.5	4.3	4.8	G3-PCX [26]
simple GA	**2.4**	**2.7**	9.0	102	272	4181	4362	3753	4394	16462	simple GA [22]
GLOBAL	**2.5**	3.7	5.2	5.5	4.0	3.3	**2.8**	**2.4**	**2.3**	**2.3**	GLOBAL [23]
iAMaLGaM IDEA	**2.4**	**2.0**	**2.1**	**2.9**	3.1	3.7	4.1	4.2	4.3	4.8	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.5	3.6	**2.8**	3.7	3.3	3.5	3.6	3.6	3.6	3.6	IPOP-SEP-CMA-ES [29]
LSfminbnd	14	224	492	810	506	396	313	258	224	187	LSfminbnd [28]
LSstep	244	693	1155	988	1002	819	675	763	669	1687	LSstep [28]
MA-LS-Chain	3.8	4.6	4.3	10	10	10	9.1	8.9	8.3	8.1	MA-LS-Chain [21]
MCS	**2.1**	**1.5**	3.0	164	118	141	144	128	153	214	MCS [18]
NELDER (Han)	**1.6**	**1.2**	**1.7**	**1.5**	**1.3**	**1.3**	**1.2**	**1.2**	**1.2**	**1.3**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.4**	**1.9**	**2.1**	3.4	3.8	4.0	4.1	4.0	4.1	4.8	NEWUOA [31]
(1+1)-ES	**2.1**	3.2	**1.7**	**2.0**	**1.8**	**1.8**	**2.0**	**2.0**	**2.1**	3.0	(1+1)-ES [1]
POEMS	161	91	31	74	83	93	101	92	99	110	POEMS [20]
PSO	3.8	4.0	**2.9**	8.0	13	17	18	22	25	28	PSO [7]
PSO_Bounds	**2.2**	**2.3**	**2.9**	12	26	104	117	127	123	121	PSO_Bounds [8]
Monte Carlo	**2.8**	**1.9**	7.7	200	8745	1.14e5	*26e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	3.9	4.0	**2.1**	**1.8**	**1.7**	**1.7**	**1.6**	**1.8**	**1.7**	**1.6**	Rosenbrock [27]
VNS (Garcia)	**2.2**	**2.3**	5.6	5.9	4.8	4.6	4.3	4.0	3.9	3.8	VNS (Garcia) [11]

Table 31: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_7 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.87	3.8	22	114	155	161	161	161	178	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.1**	**2.0**	6.2	10	7.0	8.7	9.3	9.3	9.3	11	ALPS-GA [17]
AMaLGaM IDEA	**1.2**	**2.1**	**2.6**	**1.6**	**2.1**	3.1	3.0	3.0	3.0	**2.9**	AMaLGaM IDEA [4]
BayEDAcG	**1.4**	**1**	3.6	52	72	85	*56e-2/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.0**	3.3	**2.8**	**1.1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1.8**	4.1	17	86	*37e-1/100*	.	.	.	.	.	BFGS [30]
Cauchy EDA	7.1	16	14	6.1	**1.9**	**1.8**	**1.9**	**1.9**	**1.9**	**2.0**	Cauchy EDA [24]
(1+1)-CMA-ES	**1.4**	3.5	**2.7**	**2.1**	**1**	**1.4**	**1.4**	**1.4**	**1.4**	**1.3**	(1+1)-CMA-ES [2]
DASA	24	57	85	265	123	1268	1618	1618	1618	1458	DASA [19]
DEPSO	**1.2**	**1.7**	5.2	6.1	5.9	5.1	5.1	5.1	5.1	5.3	DEPSO [12]
DIRECT	**1**	**1.4**	**2.9**	**2.8**	**2.1**	31	34	34	34	30	DIRECT [25]
EDA-PSO	**1.3**	**1.9**	3.3	3.7	8.8	17	20	20	20	22	EDA-PSO [6]
full NEWUOA	**1.2**	3.4	**1.0**	**1**	**1.4**	**2.2**	6.8	6.8	6.8	6.2	full NEWUOA [31]
G3-PCX	**1.1**	**1.5**	6.2	8.3	12	16	54	54	54	48	G3-PCX [26]
simple GA	**1.3**	**2.2**	3.3	24	27	134	196	196	196	252	simple GA [22]
GLOBAL	**1.3**	**2.2**	6.2	5.4	4.6	8.8	51	51	51	46	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	3.3	**2.6**	15	8.1	6.1	6.0	6.0	6.0	5.4	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.2	3.3	**2.7**	**2.9**	**1.4**	**1.3**	**1.3**	**1.3**	**1.3**	**1.4**	IPOP-SEP-CMA-ES [29]
LSfminbnd	8.7	19	46	68	33	101	289	289	289	263	LSfminbnd [28]
LSstep	**1.6**	206	302	324	392	934	*22e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1.3**	**2.1**	6.1	4.3	**2.2**	3.1	3.9	3.9	3.9	3.9	MA-LS-Chain [21]
MCS	**1**	**1.1**	**1**	5.7	**2.4**	4.2	4.1	4.1	4.1	8.8	MCS [18]
NELDER (Han)	**1.7**	**3.0**	8.0	28	20	23	30	30	30	27	NELDER (Han) [16]
NELDER (Doe)	**1.1**	**1.9**	7.5	4.2	4.3	4.2	8.8	8.8	8.8	8.8	NELDER (Doe) [5]
NEWUOA	**1.3**	**2.6**	11	12	10	14	39	39	39	35	NEWUOA [31]
(1+1)-ES	**1.1**	**2.3**	**2.0**	3.6	3.9	7.7	9.3	9.3	9.3	8.4	(1+1)-ES [1]
POEMS	175	270	81	29	12	18	21	21	21	20	POEMS [20]
PSO	**1.1**	**2.2**	3.5	5.3	3.1	4.4	5.1	5.1	5.1	5.1	PSO [7]
PSO_Bounds	**1.3**	**2.0**	4.1	7.3	4.8	9.3	12	12	12	13	PSO_Bounds [8]
Monte Carlo	**1.3**	**2.0**	5.0	30	134	3851	15557	15557	15557	*55e-4/1e6*	Monte Carlo [3]
Rosenbrock	41	136	97	153	369	*79e-2/3e3*	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	3.2	7.5	4.2	**2.6**	3.0	4.1	4.1	4.1	3.9	VNS (Garcia) [11]

Table 32: Running time excess ERT/ERT$_{\text{best}}$ on f_8 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	1.4	4.9	9.1	15	51	60	63	65	66	69	ERT$_{\text{best}}$/D
ALPS-GA	**2.8**	8.5	23	46	33	64	91	122	148	212	ALPS-GA [17]
AMaLGaM IDEA	5.1	**2.9**	3.8	10	5.8	6.2	6.9	7.5	7.8	8.3	AMaLGaM IDEA [4]
BayEDAcG	3.7	4.7	11	105	562	*73e-2/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.8	3.8	3.5	8.0	4.5	4.8	5.1	5.2	5.4	5.6	BIPOP-CMA-ES [15]
BFGS	3.3	**2.1**	**1.4**	**2.7**	**1.1**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	BFGS [30]
Cauchy EDA	24	18	21	28	14	14	15	15	16	17	Cauchy EDA [24]
(1+1)-CMA-ES	**1.7**	**1.6**	**1.9**	6.3	**2.8**	**2.8**	**3.0**	3.1	3.2	3.4	(1+1)-CMA-ES [2]
DASA	38	22	15	472	469	741	1156	1539	1982	2844	DASA [19]
DEPSO	6.7	8.1	7.7	14	11	24	63	*62e-4/2e3*	.	.	DEPSO [12]
DIRECT	**1.5**	**1.4**	**2.0**	5.0	3.5	9.0	15	22	29	42	DIRECT [25]
EDA-PSO	**2.9**	4.0	6.8	74	70	110	153	211	264	370	EDA-PSO [6]
full NEWUOA	3.7	**1.9**	**1.4**	**2.8**	**1.1**	**1.0**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	**2.5**	4.3	4.2	16	9.0	9.2	9.2	9.1	9.1	9.0	G3-PCX [26]
simple GA	**2.5**	3.4	47	165	404	*49e-3/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**2.6**	9.2	11	8.2	**2.8**	**2.6**	**2.5**	**2.5**	**2.5**	**2.5**	GLOBAL [23]
iAMaLGaM IDEA	**2.6**	**2.4**	**2.2**	8.1	4.5	4.9	5.0	5.3	5.6	5.9	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.8	**1.9**	3.0	8.3	6.2	6.6	6.9	6.9	7.1	7.2	IPOP-SEP-CMA-ES [29]
LSfminbnd	10	4.4	24	811	2771	2352	2237	2212	*96e-2/1e4*	.	LSfminbnd [28]
LSstep	149	70	51	681	2800	2376	2260	2181	2147	*73e-2/1e4*	LSstep [28]
MA-LS-Chain	4.7	4.5	6.6	14	7.7	10	11	11	12	12	MA-LS-Chain [21]
MCS	**1**	**1**	**1.0**	**1**	7.2	6.2	6.1	5.9	5.9	5.7	MCS [18]
NELDER (Han)	**1.6**	**1.0**	**1**	**2.1**	**1**	**1**	**1.0**	**1.1**	**1.1**	**1.2**	NELDER (Han) [16]
NELDER (Doe)	**2.1**	**2.1**	**1.6**	4.0	**1.5**	**1.4**	**1.4**	**1.4**	**1.5**	**1.5**	NELDER (Doe) [5]
NEWUOA	3.1	**1.5**	**1.4**	**2.8**	**1.2**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	NEWUOA [31]
(1+1)-ES	4.5	3.3	**2.8**	45	20	38	64	91	120	171	(1+1)-ES [1]
POEMS	138	50	37	94	48	68	168	285	326	408	POEMS [20]
PSO	**2.9**	4.4	10	46	52	91	147	208	263	381	PSO [7]
PSO_Bounds	**2.5**	4.0	17	60	157	582	731	842	917	997	PSO_Bounds [8]
Monte Carlo	**2.7**	6.9	43	1038	10072	1.20e5	*38e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	4.2	**1.8**	**1.7**	6.9	**3.0**	3.0	3.0	3.0	3.1	3.0	Rosenbrock [27]
VNS (Garcia)	**2.5**	10	7.7	9.4	5.1	5.3	5.6	5.7	5.9	6.1	VNS (Garcia) [11]

Table 33: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_9 in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.33	0.33	6.9	22	42	50	53	55	56	59	$\mathrm{ERT_{best}}$/D
ALPS-GA	7.9	130	30	30	48	83	105	132	166	222	ALPS-GA [17]
AMaLGaM IDEA	15	40	5.4	6.2	6.0	6.5	7.1	7.7	8.1	8.6	AMaLGaM IDEA [4]
BayEDAcG	15	60	12	113	*12e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	10	30	3.9	4.6	4.4	4.7	4.9	5.1	5.3	5.6	BIPOP-CMA-ES [15]
BFGS	9.3	20	**1.5**	**1.5**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	BFGS [30]
Cauchy EDA	144	292	24	17	16	17	17	18	19	20	Cauchy EDA [24]
(1+1)-CMA-ES	8.2	36	**2.7**	4.5	3.6	3.6	3.7	3.8	3.9	4.1	(1+1)-CMA-ES [2]
DASA	198	386	24	790	715	982	1437	1936	2497	3608	DASA [19]
DEPSO	8.0	77	15	19	27	55	565	*46e-4/2e3*	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	**1.7**	6.2	9.1	18	27	29	38	DIRECT [25]
EDA-PSO	7.0	42	7.5	49	69	119	186	264	346	495	EDA-PSO [6]
full NEWUOA	9.4	18	**1.6**	**1.4**	**1.0**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	11	53	5.4	14	12	12	12	12	12	12	G3-PCX [26]
simple GA	8.4	132	49	103	3762	28393	*11e-2/1e5*	.	.	.	simple GA [22]
GLOBAL	10	102	14	6.2	3.5	3.2	3.1	3.1	3.1	3.1	GLOBAL [23]
iAMaLGaM IDEA	12	28	3.3	5.0	4.9	5.0	5.4	5.8	6.0	6.4	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	10	28	3.7	5.6	7.4	8.2	8.1	8.2	8.3	8.4	IPOP-SEP-CMA-ES [29]
LSfminbnd	25	61	4.7	185	305	875	1290	2563	2633	*71e-3/1e4*	LSfminbnd [28]
LSstep	391	3040	175	401	3315	2843	*56e-2/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	12	73	11	10	8.7	10	11	11	12	13	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	**1.1**	**1.1**	**1.2**	**1.2**	**1.2**	MCS [18]
NELDER (Han)	**5.2**	**12**	**1.2**	**1.2**	**1.0**	**1.0**	**1.1**	**1.1**	**1.2**	**1.3**	NELDER (Han) [16]
NELDER (Doe)	6.9	18	**1.5**	**1.4**	**1.1**	**1.1**	**1.1**	**1.1**	**1.2**	**1.3**	NELDER (Doe) [5]
NEWUOA	7.7	22	**1.7**	**1.7**	**1.2**	**1.2**	**1.2**	**1.2**	**1.3**	**1.3**	NEWUOA [31]
(1+1)-ES	11	32	**2.6**	79	71	88	116	148	179	237	(1+1)-ES [1]
POEMS	651	784	66	69	68	147	248	379	500	910	POEMS [20]
PSO	9.3	75	11	17	34	66	126	204	274	443	PSO [7]
PSO_Bounds	11	59	13	77	374	527	670	781	883	1030	PSO_Bounds [8]
Monte Carlo	12	71	43	675	10480	2.86e5	*43e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	13	23	**1.6**	**2.6**	**2.7**	**2.6**	**2.7**	**2.8**	**2.9**	**2.9**	Rosenbrock [27]
VNS (Garcia)	20	136	11	6.8	6.0	6.2	6.3	6.5	6.7	7.0	VNS (Garcia) [11]

Table 34: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{10} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	10	18	38	51	56	60	65	69	73	81	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	23	38	50	120	363	704	1283	1914	2624	7058	ALPS-GA [17]
AMaLGaM IDEA	3.2	3.0	**2.0**	**2.3**	**2.7**	**2.9**	3.2	3.4	3.6	3.8	AMaLGaM IDEA [4]
BayEDAcG	88	1572	*37e+1/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	8.1	5.6	4.1	4.1	4.6	4.9	4.9	4.9	4.9	4.8	BIPOP-CMA-ES [15]
BFGS	**1.4**	**1**	**1.0**	**1.2**	**1.2**	**1.2**	**1.4**	**1.5**	5.9	76	BFGS [30]
Cauchy EDA	13	9.4	6.3	6.2	6.7	7.3	7.8	8.3	8.7	10	Cauchy EDA [24]
(1+1)-CMA-ES	4.5	3.1	**2.7**	**2.7**	**2.7**	3.0	3.1	3.0	3.0	3.0	(1+1)-CMA-ES [2]
DASA	131	177	11372	43969	2.53e5	*24e-1/1e6*	.	.	.	.	DASA [19]
DEPSO	13	35	67	112	*55e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	4.1	8.4	7.6	49	118	161	495	481	998	1970	DIRECT [25]
EDA-PSO	20	66	213	2444	4219	7032	10880	*61e-2/1e5*	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.6**	**1.6**	**2.6**	3.9	4.4	4.9	5.6	6.0	7.1	full NEWUOA [31]
G3-PCX	8.8	7.2	14	21	28	30	36	39	41	42	G3-PCX [26]
simple GA	30	90	202	1999	12116	*55e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	10	6.0	3.3	**2.8**	**2.7**	**2.6**	**2.5**	**2.4**	**2.3**	**2.2**	GLOBAL [23]
iAMaLGaM IDEA	3.3	**2.5**	**1.8**	**2.1**	**2.6**	**2.9**	**3.0**	3.1	3.2	3.3	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	22	17	11	10	10	9.2	8.8	8.5	8.2	7.8	IPOP-SEP-CMA-ES [29]
LSfminbnd	339	479	1748	2781	2533	*61e+0/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	1147	2402	1713	*53e+1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	16	13	10	11	12	12	13	12	12	12	MA-LS-Chain [21]
MCS	23	14	67	168	825	4108	3830	*29e-2/2e4*	.	.	MCS [18]
NELDER (Han)	**1.8**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**2.0**	**1.3**	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.0**	**1.1**	NELDER (Doe) [5]
NEWUOA	**1.4**	**1.3**	**2.8**	5.2	8.3	10	12	13	14	16	NEWUOA [31]
(1+1)-ES	28	322	2118	6181	12304	23320	75816	*36e-4/1e6*	.	.	(1+1)-ES [1]
POEMS	49	72	412	1626	5319	11673	*51e-2/1e5*	.	.	.	POEMS [20]
PSO	9.2	12	59	1052	2449	3640	4770	6734	6486	18273	PSO [7]
PSO_Bounds	13	31	2085	8021	11840	11261	22203	20881	19826	18138	PSO_Bounds [8]
Monte Carlo	34	212	2055	59914	2.54e5	*11e-1/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.6**	3.9	8.5	7.8	7.2	6.8	6.5	6.4	6.9	6.5	Rosenbrock [27]
VNS (Garcia)	9.3	7.1	5.9	6.0	5.9	5.8	5.7	5.6	5.5	5.3	VNS (Garcia) [11]

Table 35: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	3.1	3.9	22	35	76	88	92	96	101	109	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	19	48	31	123	248	515	1087	1781	2566	4958	ALPS-GA [17]
AMaLGaM IDEA	5.5	7.0	3.1	**3.0**	**1.7**	**1.9**	**2.1**	**2.3**	**2.5**	**2.8**	AMaLGaM IDEA [4]
BayEDAcG	10	23	91	813	*85e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	5.7	14	10	7.5	4.0	3.6	3.7	3.7	3.7	3.6	BIPOP-CMA-ES [15]
BFGS	**2.1**	**1.9**	**1**	**1**	**1**	**1.4**	3.7	11	41	*33e-7/7e3*	BFGS [30]
Cauchy EDA	19	24	7.8	6.5	4.1	4.3	5.0	5.2	5.6	6.4	Cauchy EDA [24]
(1+1)-CMA-ES	4.6	10	5.8	4.6	**2.7**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	(1+1)-CMA-ES [2]
DASA	15	16	4627	9340	14017	21548	33286	43248	41659	39180	DASA [19]
DEPSO	10	62	127	266	*89e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	5.7	6.4	13	28	153	387	771	*24e-4/3e4*	.	.	DIRECT [25]
EDA-PSO	10	28	74	292	495	1139	5108	*41e-4/1e5*	.	.	EDA-PSO [6]
full NEWUOA	**2.3**	6.9	3.2	3.6	**2.5**	**2.6**	3.1	3.5	3.9	4.7	full NEWUOA [31]
G3-PCX	8.7	10	30	93	100	140	183	206	256	315	G3-PCX [26]
simple GA	17	66	74	2067	5574	*90e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	14	23	5.4	3.9	**2.0**	**1.8**	**1.8**	**1.8**	**1.7**	**1.7**	GLOBAL [23]
iAMaLGaM IDEA	4.6	6.7	3.1	3.1	**1.9**	**1.9**	**2.0**	**2.1**	**2.2**	**2.4**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	5.2	20	17	15	7.4	6.6	6.6	6.5	6.4	6.1	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.1**	186	1788	*32e+0/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**2.1**	400	2905	*36e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	13	24	21	22	11	10	10	10	10	10	MA-LS-Chain [21]
MCS	**1**	**1**	49	82	101	512	*24e-3/2e4*	.	.	.	MCS [18]
NELDER (Han)	3.0	3.4	**2.2**	**2.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1.1**	NELDER (Han) [16]
NELDER (Doe)	3.2	3.7	**2.3**	**2.0**	**1.1**	**1**	**1**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.7**	8.8	3.1	3.4	**2.5**	**2.6**	3.2	3.7	4.0	5.1	NEWUOA [31]
(1+1)-ES	3.7	1294	8357	14557	17402	1.69e5	*37e-3/1e6*	.	.	.	(1+1)-ES [1]
POEMS	79	100	366	1008	830	1486	1738	2078	2078	3150	POEMS [20]
PSO	12	30	60	154	164	275	360	445	534	994	PSO [7]
PSO_Bounds	9.0	25	245	741	606	1040	1566	1607	1635	1680	PSO_Bounds [8]
Monte Carlo	22	52	132	2170	61381	*13e-2/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.7**	**2.7**	17	12	5.9	5.3	5.1	5.0	4.9	4.7	Rosenbrock [27]
VNS (Garcia)	12	30	14	10	4.8	4.5	4.4	4.4	4.4	4.3	VNS (Garcia) [11]

Table 36: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{12} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	10	13	22	56	113	134	148	208	232	263	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	73	85	94	102	169	462	1578	3448	14103	93051	ALPS-GA [17]
AMaLGaM IDEA	5.9	6.4	4.7	4.2	4.8	5.2	5.6	4.9	4.9	5.2	AMaLGaM IDEA [4]
BayEDAcG	27	26	67	82	121	216	*38e-1/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	5.2	4.8	7.9	5.7	4.5	4.7	4.8	3.9	4.0	4.1	BIPOP-CMA-ES [15]
BFGS	**1.9**	**1.5**	**1.7**	**1.4**	**1**	**1**	**1**	**2.0**	**2.3**	43	BFGS [30]
Cauchy EDA	26	26	34	26	17	16	16	13	13	13	Cauchy EDA [24]
(1+1)-CMA-ES	3.8	4.3	8.5	6.1	4.3	4.2	4.2	3.3	3.6	3.5	(1+1)-CMA-ES [2]
DASA	17	17	30874	35803	35526	*81e-1/1e6*	.	.	.	.	DASA [19]
DEPSO	24	25	80	161	263	*67e-1/2e3*	.	.	.	.	DEPSO [12]
DIRECT	4.6	4.6	7.0	6.5	5.7	10	58	53	49	244	DIRECT [25]
EDA-PSO	191	259	960	1750	5856	10557	9520	6805	*91e-2/1e5*	.	EDA-PSO [6]
full NEWUOA	**1**	**1.9**	**2.9**	**2.2**	**1.6**	**1.7**	**1.7**	**1.4**	**1.5**	**1.6**	full NEWUOA [31]
G3-PCX	4.8	4.3	6.0	11	8.9	10	10	8.0	7.9	8.1	G3-PCX [26]
simple GA	199	380	426	2378	12635	10657	*11e-1/1e5*	.	.	.	simple GA [22]
GLOBAL	11	8.6	5.9	3.1	**2.0**	**2.4**	**2.4**	**2.2**	**2.8**	4.0	GLOBAL [23]
iAMaLGaM IDEA	4.1	4.4	10	8.0	6.1	6.0	5.9	4.7	4.7	4.6	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	5.4	5.6	10	10	8.4	9.1	8.7	6.7	7.0	6.8	IPOP-SEP-CMA-ES [29]
LSfminbnd	6.0	6.2	697	1164	*14e+0/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	87	73	1376	791	400	*34e+0/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	16	14	25	15	10	11	11	8.8	9.1	8.9	MA-LS-Chain [21]
MCS	**1.3**	**1.1**	**1**	**1**	**1.2**	**1.2**	**2.7**	**2.5**	4.5	18	MCS [18]
NELDER (Han)	**1.5**	**1.4**	**2.0**	**1.7**	**1.3**	**1.3**	**1.3**	**1.0**	**1.0**	**1.1**	NELDER (Han) [16]
NELDER (Doe)	**1.5**	**1.4**	**1.8**	**1.6**	**1.3**	**1.2**	**1.3**	**1**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.2**	**1**	**2.0**	**1.6**	**1.2**	**1.2**	**1.3**	**1.0**	**1.1**	**1.2**	NEWUOA [31]
(1+1)-ES	**2.7**	7175	27976	26930	39441	1.08e5	*12e-1/1e6*	.	.	.	(1+1)-ES [1]
POEMS	102	165	1824	1649	3812	5006	*69e-2/1e5*	.	.	.	POEMS [20]
PSO	30	41	2354	2709	5784	10494	*33e-1/1e5*	.	.	.	PSO [7]
PSO_Bounds	112	285	2014	2209	2538	10584	9537	*24e-1/1e5*	.	.	PSO_Bounds [8]
Monte Carlo	1748	11048	1.56e5	*26e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.6**	**1.5**	38	19	10	9.4	8.9	6.9	7.4	11	Rosenbrock [27]
VNS (Garcia)	9.3	10	13	9.5	6.0	5.6	5.6	4.6	4.4	4.4	VNS (Garcia) [11]

Table 37: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{13} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.53	5.6	16	28	36	45	72	85	94	122	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.5**	12	48	66	100	204	414	1629	5365	22406	ALPS-GA [17]
AMaLGaM IDEA	**1.4**	4.3	3.7	3.9	4.2	4.3	3.4	3.4	3.5	3.4	AMaLGaM IDEA [4]
BayEDAcG	**1.5**	34	45	124	*24e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.6**	**2.6**	3.7	3.8	5.0	6.1	4.5	4.4	4.8	4.6	BIPOP-CMA-ES [15]
BFGS	3.5	**1.5**	**1.1**	**1**	**1**	**1**	**2.1**	31	408	*25e-6/9e3*	BFGS [30]
Cauchy EDA	39	22	14	12	12	12	9.4	9.2	10	9.3	Cauchy EDA [24]
(1+1)-CMA-ES	**1.9**	**2.9**	4.1	4.5	5.9	6.9	5.9	5.9	6.1	6.0	(1+1)-CMA-ES [2]
DASA	18	52	315	1052	1626	6078	19575	39746	1.54e5	*46e-5/1e6*	DASA [19]
DEPSO	**1.9**	10	14	60	100	206	*11e-2/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1.9**	**2.9**	6.8	6.8	16	29	31	61	155	DIRECT [25]
EDA-PSO	**1.2**	4.7	48	144	397	1412	5775	*73e-4/1e5*	.	.	EDA-PSO [6]
full NEWUOA	**2.2**	**1**	**3.0**	10	38	78	117	263	676	*51e-5/9e3*	full NEWUOA [31]
G3-PCX	**1.5**	4.8	20	73	97	111	159	220	226	210	G3-PCX [26]
simple GA	**2.2**	12	151	252	3645	14939	20234	*16e-2/1e5*	.	.	simple GA [22]
GLOBAL	**1.3**	9.4	6.6	4.5	6.3	8.4	88	*35e-4/400*	.	.	GLOBAL [23]
iAMaLGaM IDEA	**2.2**	3.2	**2.9**	**2.7**	3.1	3.0	**2.4**	**2.5**	**2.6**	**2.5**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.6**	3.0	8.6	15	16	13	8.9	8.5	8.3	7.1	IPOP-SEP-CMA-ES [29]
LSfminbnd	5.9	14	123	225	616	1472	*39e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	118	150	514	1492	*65e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**2.2**	7.9	10	13	17	17	13	12	12	12	MA-LS-Chain [21]
MCS	**1**	**1.7**	14	127	373	367	710	826	*22e-4/2e4*	.	MCS [18]
NELDER (Han)	**1.9**	**1.2**	**1**	**1.1**	**1.2**	**1.3**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1.5**	**1.3**	**1.0**	**1.1**	**1.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.1**	NELDER (Doe) [5]
NEWUOA	**2.0**	**1.0**	4.5	9.0	42	62	200	1207	*12e-4/7e3*	.	NEWUOA [31]
(1+1)-ES	**1.7**	**2.3**	16	65	125	289	1031	1592	3306	57184	(1+1)-ES [1]
POEMS	280	52	73	667	1721	4887	*19e-3/1e5*	.	.	.	POEMS [20]
PSO	**1.2**	5.8	19	221	2239	5002	19551	16534	14964	*71e-3/1e5*	PSO [7]
PSO_Bounds	**1.5**	6.6	981	1358	1196	8972	9197	*42e-3/1e5*	.	.	PSO_Bounds [8]
Monte Carlo	**1.7**	13	1322	1.59e5	*17e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	4.5	**2.9**	5.0	8.6	9.2	20	31	82	127	322	Rosenbrock [27]
VNS (Garcia)	**1**	10	7.1	6.0	7.8	12	8.5	7.8	7.5	7.2	VNS (Garcia) [11]

Table 38: Running time excess ERT/ERT_{best} on f_{14} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.33	0.33	0.73	5.8	9.5	14	24	31	37	65	ERT_{best}/D
ALPS-GA	**1**	**1.2**	**2.3**	10	55	71	69	81	203	2460	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.2**	**2.1**	**2.7**	4.5	5.0	4.5	4.5	4.7	3.6	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	**1.6**	58	124	110	248	277	783	*28e-4/2e3*	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.3**	3.1	**2.9**	3.5	4.2	4.4	6.4	7.1	5.9	BIPOP-CMA-ES [15]
BFGS	**1**	**2.1**	3.7	**1.5**	**1.5**	**1.3**	**1.1**	**1**	**1**	29	BFGS [30]
Cauchy EDA	**1**	**1**	20	15	17	18	14	14	14	11	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.1**	**2.1**	**1.4**	**2.2**	**2.6**	**2.9**	4.0	4.2	3.6	(1+1)-CMA-ES [2]
DASA	**1**	13	43	24	20	23	51	396	2888	48461	DASA [19]
DEPSO	**1**	**1**	**1.5**	4.9	12	16	17	26	132	*11e-6/2e3*	DEPSO [12]
DIRECT	**1**	**1**	**1.8**	**1.7**	**2.7**	5.5	17	45	107	483	DIRECT [25]
EDA-PSO	**1**	**1.1**	**1.8**	4.2	11	21	76	132	191	6528	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	6.2	**1.4**	**1.2**	**1.0**	**1**	**1.5**	**2.3**	4.4	full NEWUOA [31]
G3-PCX	**1**	**1.1**	**2.0**	4.0	4.6	4.2	4.9	11	45	285	G3-PCX [26]
simple GA	**1**	**1**	**1.9**	10	156	281	319	1594	6037	*25e-6/1e5*	simple GA [22]
GLOBAL	**1**	**1**	**2.5**	8.4	11	7.4	5.1	4.8	12	*11e-6/300*	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	**2.7**	**2.4**	3.2	3.7	3.1	3.2	3.6	**3.2**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.1**	**2.8**	**2.6**	3.6	4.2	4.8	10	11	8.3	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	7.2	4.4	3.5	6.1	67	596	*31e-5/1e4*	.	LSfminbnd [28]
LSstep	**1**	29	208	84	70	161	926	*22e-4/1e4*	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	**1.8**	6.7	11	12	10	11	15	13	MA-LS-Chain [21]
MCS	**1**	**1**	**2.5**	12	11	7.9	5.7	6.0	50	*20e-7/2e4*	MCS [18]
NELDER (Han)	**1**	**1.3**	**1.9**	**1**	**1.2**	**1.3**	**1.2**	**1.3**	**1.3**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.7**	**1.1**	**1.4**	**1.8**	**1.5**	**1.5**	**1.6**	**1.2**	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	4.1	**1.1**	**1**	**1**	**1.2**	**2.1**	3.0	17	NEWUOA [31]
(1+1)-ES	**1**	**1.1**	**2.2**	**1.8**	**1.9**	**2.5**	5.8	115	2366	*16e-7/1e6*	(1+1)-ES [1]
POEMS	**1**	139	251	55	91	112	146	162	224	10353	POEMS [20]
PSO	**1**	**1.1**	**1**	3.1	14	24	30	45	76	2007	PSO [7]
PSO_Bounds	**1**	**1**	**2.7**	4.0	33	62	86	141	277	1127	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	**2.1**	17	425	19016	6.04e5	*43e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	**2.5**	5.5	**1.4**	**1.3**	**1.5**	**2.0**	**2.4**	3.1	14	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**1**	7.1	8.7	8.3	7.5	7.7	8.4	7.2	VNS (Garcia) [11]

Table 39: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_{15} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.33	0.78	40	457	2095	2761	2810	2863	2929	3014	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1.3**	3.3	7.6	5.3	3.9	4.2	4.4	4.6	4.8	5.1	ALPS-GA [17]
AMaLGaM IDEA	**1.3**	**1.8**	**1.2**	5.0	3.7	3.1	3.0	3.0	**3.0**	**2.9**	AMaLGaM IDEA [4]
BayEDAcG	**1.5**	**2.4**	3.1	11	14	*11e-1/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.9**	4.4	**1.9**	**1.3**	**1.7**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	BIPOP-CMA-ES [15]
BFGS	5.8	27	7.3	17	22	17	16	16	16	15	BFGS [30]
Cauchy EDA	9.2	46	3.9	5.4	27	*78e-3/5e4*	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1.5**	3.9	**1**	5.8	9.5	7.2	7.1	6.9	6.8	6.6	(1+1)-CMA-ES [2]
DASA	10	36	56	202	197	149	147	144	141	137	DASA [19]
DEPSO	**1.5**	**1**	3.4	6.6	3.3	**2.6**	**2.6**	**2.6**	*10e-1/2e3*	.	DEPSO [12]
DIRECT	**1**	**1.4**	**1.0**	**1.5**	**1**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	DIRECT [25]
EDA-PSO	**1.2**	**1.6**	3.8	7.4	9.5	7.4	7.3	7.4	7.4	7.5	EDA-PSO [6]
full NEWUOA	**1.3**	3.3	**2.2**	**2.8**	8.8	6.7	6.5	6.4	6.3	6.1	full NEWUOA [31]
G3-PCX	**1.4**	**2.9**	40	28	39	30	29	29	28	27	G3-PCX [26]
simple GA	**1.4**	3.0	14	20	62	62	62	64	83	150	simple GA [22]
GLOBAL	**1.2**	**2.3**	**2.7**	3.2	3.9	**3.0**	**2.9**	**2.9**	**2.8**	**2.7**	GLOBAL [23]
iAMaLGaM IDEA	**1.4**	3.0	6.2	5.6	4.6	3.6	3.6	3.5	3.5	3.4	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.7**	4.4	**2.3**	**2.2**	**1.3**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	5.5	4.8	21	20	15	15	15	15	14	LSfminbnd [28]
LSstep	**1.2**	173	384	144	67	51	50	50	49	48	LSstep [28]
MA-LS-Chain	**1.5**	3.1	**2.6**	**1.6**	3.3	**2.5**	**2.5**	**2.5**	**2.4**	**2.4**	MA-LS-Chain [21]
MCS	**1**	**1.4**	**1.8**	**1**	**1.8**	**1.4**	**1.3**	**1.3**	**1.6**	**1.5**	MCS [18]
NELDER (Han)	**1.3**	**2.9**	**2.3**	4.6	9.4	7.1	7.0	6.9	6.7	6.5	NELDER (Han) [16]
NELDER (Doe)	**2.3**	**2.5**	**1.4**	**1.0**	**2.5**	**1.9**	**1.9**	**1.9**	**1.8**	**1.8**	NELDER (Doe) [5]
NEWUOA	**1.3**	**2.2**	3.5	3.4	4.5	3.4	3.3	3.3	3.2	3.1	NEWUOA [31]
(1+1)-ES	**2.2**	4.5	3.4	6.2	13	10	10	10	10	9.3	(1+1)-ES [1]
POEMS	39	193	14	32	77	59	58	57	57	56	POEMS [20]
PSO	**1.5**	**2.8**	**2.7**	4.0	58	44	44	43	42	41	PSO [7]
PSO_Bounds	**1.3**	3.8	**2.8**	27	27	21	22	22	21	22	PSO_Bounds [8]
Monte Carlo	**1.5**	**2.2**	29	1548	*65e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	5.9	38	11	11	19	15	14	14	14	13	Rosenbrock [27]
VNS (Garcia)	**1.4**	**2.6**	3.0	**3.0**	3.7	**2.8**	**2.8**	**2.9**	**2.9**	4.5	VNS (Garcia) [11]

Table 40: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{16} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.33	0.40	14	106	194	263	621	720	1068	1120	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS-GA	**1**	**1.1**	**1.1**	5.9	9.1	13	9.0	13	10	16	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.6**	**1.8**	5.2	10	11	6.0	5.3	3.9	3.7	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.4**	**1.7**	25	*98e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.5**	**2.1**	3.5	4.3	**3.3**	**1.7**	**1.5**	**1.1**	**1.1**	BIPOP-CMA-ES [15]
BFGS	**1**	**2.8**	72	154	*14e-1/7e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	3.0	5.2	28	1111	*14e-2/5e4*	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.2**	4.3	4.8	7.9	10	10	14	10	18	(1+1)-CMA-ES [2]
DASA	**1**	8.7	37	135	303	508	1001	2222	2901	2862	DASA [19]
DEPSO	**1**	**1.3**	3.9	5.9	29	*15e-2/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1.2**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1.2**	**1.9**	DIRECT [25]
EDA-PSO	**1**	**1.3**	**1.5**	19	106	163	97	93	73	72	EDA-PSO [6]
full NEWUOA	**1**	**1.9**	3.3	4.2	9.0	17	13	69	99	*26e-5/8e3*	full NEWUOA [31]
G3-PCX	**1**	**1**	**1**	3.2	11	18	13	27	58	103	G3-PCX [26]
simple GA	**1**	**1.4**	**1.0**	6.0	61	339	490	942	654	1288	simple GA [22]
GLOBAL	**1**	**1.4**	**1.6**	**1.1**	**1.3**	**1.6**	**1.6**	**1.7**	**1.3**	3.4	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	**1.9**	**1.9**	10	9.2	6.0	5.2	3.5	3.6	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.4**	**2.1**	3.5	4.0	3.5	**1.6**	**1.4**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.2**	**1.6**	3.5	19	50	101	*12e-3/9e3*	.	.	LSfminbnd [28]
LSstep	**1**	**1.3**	4.0	8.7	94	172	239	207	139	133	LSstep [28]
MA-LS-Chain	**1**	**1.2**	**1.6**	**1.6**	4.8	5.6	5.7	6.4	6.0	6.2	MA-LS-Chain [21]
MCS	**1**	**1.3**	4.1	**2.1**	11	33	127	*18e-4/2e4*	.	.	MCS [18]
NELDER (Han)	**1**	**1.3**	3.7	7.0	21	29	13	17	14	14	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**1.2**	**2.8**	**3.4**	3.9	3.2	3.5	**2.6**	6.3	NELDER (Doe) [5]
NEWUOA	**1**	**2.9**	4.5	6.7	12	58	149	129	*13e-3/6e3*	.	NEWUOA [31]
(1+1)-ES	**1**	**1.8**	8.6	18	40	57	121	202	231	3981	(1+1)-ES [1]
POEMS	**1**	116	16	24	71	214	96	84	57	57	POEMS [20]
PSO	**1**	**1.6**	**1.5**	3.0	41	77	73	66	45	59	PSO [7]
PSO_Bounds	**1**	**1.4**	**1.8**	6.4	58	173	125	117	95	93	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	**1.8**	7.9	181	4362	23015	*80e-4/1e6*	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.0	22	31	93	267	230	*23e-2/1e4*	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.8**	**2.3**	6.7	5.9	9.5	4.4	4.0	3.0	8.4	VNS (Garcia) [11]

Table 41: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{17} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	1.2	26	94	164	378	602	782	1156	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.2**	**2.4**	11	13	15	9.2	8.3	8.5	8.8	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.3**	3.3	**1.5**	**1**	**1**	**2.6**	3.1	3.9	3.0	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.7**	**2.3**	6.7	7.6	17	10	16	*32e-4/2e3*	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.2**	5.3	4.0	**2.4**	**2.3**	**1.5**	**1.2**	**1.4**	**1.1**	BIPOP-CMA-ES [15]
BFGS	**1**	**2.1**	48	44	*44e-2/2e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	4.9	24	7.3	4.1	3.6	**2.2**	**1.8**	**1.8**	**1.6**	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.1**	32	7.6	7.9	32	37	75	58	*76e-5/1e4*	(1+1)-CMA-ES [2]
DASA	**1**	15	65	49	106	484	896	995	3936	12212	DASA [19]
DEPSO	**1**	**1.3**	5.1	4.0	3.5	3.5	**2.3**	**2.2**	**2.3**	5.0	DEPSO [12]
DIRECT	**1**	**1**	**1.2**	**1.0**	**1.2**	**1.5**	**1**	**1.0**	**1**	**1.2**	DIRECT [25]
EDA-PSO	**1.1**	**1.3**	**2.3**	4.0	17	29	20	17	17	16	EDA-PSO [6]
full NEWUOA	**1**	**1.7**	3.9	5.5	7.3	31	53	*35e-4/6e3*	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.3**	**2.6**	33	39	48	47	113	290	636	G3-PCX [26]
simple GA	**1**	**1.1**	**1.4**	30	57	72	72	65	115	*58e-8/1e5*	simple GA [22]
GLOBAL	**1**	**1.5**	**3.0**	4.2	7.3	21	*98e-3/400*	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	**2.4**	**1**	3.1	**2.7**	3.1	4.4	3.6	**3.0**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.2**	**2.8**	**1.8**	**2.1**	**1.8**	**1.4**	**1**	**1.1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.2**	14	8.2	30	143	*21e-3/1e4*	.	.	.	LSfminbnd [28]
LSstep	**1**	**1.5**	71	201	104	880	*69e-3/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.4**	**2.1**	3.4	4.0	4.9	3.1	**2.6**	**2.3**	**2.0**	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**2.5**	5.6	16	182	*35e-4/2e4*	.	.	MCS [18]
NELDER (Han)	**1**	**1**	62	22	44	95	95	108	253	405	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.2**	**1.9**	3.7	8.5	36	69	*12e-4/2e4*	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.6**	**2.7**	9.0	19	143	*32e-3/5e3*	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**2.5**	24	33	866	2294	4124	*12e-4/1e6*	.	.	(1+1)-ES [1]
POEMS	**1**	93	144	20	23	28	17	18	16	15	POEMS [20]
PSO	**1**	**1.1**	**2.8**	4.4	80	55	26	18	15	14	PSO [7]
PSO_Bounds	**1**	**1.3**	**2.5**	4.7	14	21	14	13	25	28	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	**2.4**	30	7200	*92e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.3**	81	2223	*20e-1/8e3*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.9**	**2.9**	**1.2**	**1.7**	**1.3**	**2.0**	4.8	18	VNS (Garcia) [11]

Table 42: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{18} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.40	13	48	430	1028	1174	1314	1579	1842	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.3**	**2.6**	5.0	17	5.5	5.2	7.2	13	18	136	ALPS-GA [17]
AMaLGaM IDEA	**1.2**	3.4	**1.6**	6.1	3.5	3.2	3.1	**2.9**	**2.5**	**2.5**	AMaLGaM IDEA [4]
BayEDAcG	**1.1**	3.0	4.5	10	67	*20e-2/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.1**	3.4	**1.4**	3.4	**1.8**	**1.1**	**1**	**1.0**	**1.1**	**1.3**	BIPOP-CMA-ES [15]
BFGS	**1**	16	33	*29e-1/3e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.3**	31	275	80	9.4	4.3	4.0	8.5	7.3	6.6	Cauchy EDA [24]
(1+1)-CMA-ES	**1.2**	3.8	**2.7**	5.0	8.3	22	40	*16e-3/1e4*	.	.	(1+1)-CMA-ES [2]
DASA	5.6	93	91	977	458	1553	*10e-3/1e6*	.	.	.	DASA [19]
DEPSO	**1.3**	**2.4**	3.8	12	3.4	5.1	12	*18e-3/2e3*	.	.	DEPSO [12]
DIRECT	**1**	**1.5**	**1.1**	**2.7**	**1**	**1**	**2.0**	**2.9**	5.0	8.3	DIRECT [25]
EDA-PSO	**1**	4.5	**2.4**	28	13	9.3	12	13	14	16	EDA-PSO [6]
full NEWUOA	**1.1**	4.6	4.2	16	13	*48e-3/7e3*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.1**	3.3	**2.4**	11	18	63	*91e-4/5e4*	.	.	.	G3-PCX [26]
simple GA	**1**	3.2	6.3	63	42	423	1228	*17e-3/1e5*	.	.	simple GA [22]
GLOBAL	**1.2**	**2.7**	3.9	5.7	4.6	*21e-2/500*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.9**	**1**	**1**	**1.6**	3.3	3.7	3.9	3.4	3.8	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.2**	4.7	**1.2**	**1.8**	**2.1**	**1.0**	**1.1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	4.4	8.7	35	33	*10e-2/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	**1**	25	42	362	328	*12e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	**2.3**	3.0	4.8	5.3	12	11	13	12	11	MA-LS-Chain [21]
MCS	**1**	**1**	4.0	**2.9**	20	*40e-3/2e4*	.	.	.	.	MCS [18]
NELDER (Han)	**1.1**	4.2	25	27	30	45	120	550	*98e-5/1e5*	.	NELDER (Han) [16]
NELDER (Doe)	**1.1**	3.5	**1.9**	5.4	7.0	16	72	203	169	*63e-4/2e4*	NELDER (Doe) [5]
NEWUOA	**1**	5.1	7.2	17	34	*12e-2/6e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1.8**	9.0	338	296	2752	13865	12138	*83e-3/1e6*	.	.	(1+1)-ES [1]
POEMS	42	247	25	176	25	24	50	95	103	171	POEMS [20]
PSO	**1**	**2.7**	**2.0**	16	57	77	99	92	113	180	PSO [7]
PSO_Bounds	**1**	**2.7**	**2.0**	169	65	57	67	68	69	780	PSO_Bounds [8]
Monte Carlo	**1.1**	**2.2**	4.7	446	*26e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.1**	165	218	2322	*50e-1/8e3*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1.2**	3.5	3.2	**2.3**	4.3	5.3	6.6	13	45	128	VNS (Garcia) [11]

Table 43: Running time excess ERT/ERT_{best} on f_{19} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.33	0.33	0.33	0.33	36	2255	2456	2460	2466	2480	ERT_{best}/D
ALPS-GA	**1**	**1**	11	469	46	**3.0**	4.6	5.2	5.5	7.1	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.2**	13	120	36	3.8	5.9	6.0	6.0	6.0	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	10	132	43	*64e-3/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.5**	13	**101**	49	**2.9**	3.2	3.2	3.2	3.3	BIPOP-CMA-ES [15]
BFGS	**1**	37	113	872	162	33	*86e-3/5e3*	.	.	.	BFGS [30]
Cauchy EDA	**1**	**2.3**	57	544	313	*53e-3/5e4*	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	6.1	970	157	8.8	17	17	17	17	(1+1)-CMA-ES [2]
DASA	**1**	3.3	60	5067	518	233	460	460	461	476	DASA [19]
DEPSO	**1**	**1**	5.4	238	41	*43e-3/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**1**	29	60	60	*10e-3/3e4*	.	DIRECT [25]
EDA-PSO	**1**	**1.4**	9.1	373	82	5.8	11	12	13	16	EDA-PSO [6]
full NEWUOA	**1**	**1.7**	25	374	56	11	17	17	17	17	full NEWUOA [31]
G3-PCX	**1**	**1.1**	7.6	925	636	103	95	95	95	94	G3-PCX [26]
simple GA	**1**	**1.2**	7.1	928	101	19	39	50	81	*68e-6/1e5*	simple GA [22]
GLOBAL	**1**	**1.1**	14	290	46	3.9	*94e-3/1e3*	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	10	156	73	7.6	7.7	7.7	7.7	7.7	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.1**	9.1	186	54	**2.6**	**2.4**	**2.4**	**2.5**	**2.5**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	3.0	26	274	54	46	*38e-3/7e3*	.	.	.	LSfminbnd [28]
LSstep	**1**	**2.0**	8.9	647	26	63	*28e-3/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	7.6	193	20	**1.6**	**2.2**	**2.2**	**2.2**	**2.3**	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**11**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1**	**1**	**4.1**	1453	118	17	40	40	40	40	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	7.6	146	**20**	5.4	11	11	11	11	NELDER (Doe) [5]
NEWUOA	**1**	**1.5**	20	1275	279	25	54	54	54	53	NEWUOA [31]
(1+1)-ES	**1**	**2.3**	10	2.15e5	31402	1776	2648	2644	2638	2624	(1+1)-ES [1]
POEMS	**1**	132	628	1366	167	40	57	58	58	59	POEMS [20]
PSO	**1**	**1.1**	10	242	24	14	24	25	25	28	PSO [7]
PSO_Bounds	**1**	**1.1**	6.7	245	91	13	26	27	30	35	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	11	1030	814	488	2939	6089	6073	*79e-4/1e6*	Monte Carlo [3]
Rosenbrock	**1**	15	253	3056	848	32	*27e-2/1e4*	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.4**	23	216	36	4.8	6.0	6.1	6.3	10	VNS (Garcia) [11]

Table 44: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_{20} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	1.8	2.6	2.8	128	764	799	827	842	858	925	$\mathrm{ERT_{best}}$/D
ALPS-GA	**2.8**	4.1	5.1	5.0	3.9	4.6	5.3	6.2	7.2	8.2	ALPS-GA [17]
AMaLGaM IDEA	**2.2**	**2.2**	**2.7**	20	26	25	25	25	24	23	AMaLGaM IDEA [4]
BayEDAcG	3.1	**3.0**	3.2	71	*13e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.2**	**2.1**	**2.3**	8.2	10	10	10	10	10	9.5	BIPOP-CMA-ES [15]
BFGS	**1.8**	**1.7**	**1.9**	**1.7**	5.5	5.3	5.1	5.0	4.9	4.6	BFGS [30]
Cauchy EDA	17	18	20	10	458	934	*31e-2/5e4*	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**2.1**	**2.6**	**2.7**	5.6	9.5	9.1	8.8	8.7	8.5	7.9	(1+1)-CMA-ES [2]
DASA	31	37	37	21	43	41	40	39	38	36	DASA [19]
DEPSO	**1.1**	4.1	5.9	**2.4**	4.9	4.8	4.8	4.9	4.8	4.7	DEPSO [12]
DIRECT	3.7	5.2	5.9	**1**	9.0	8.7	8.6	8.5	8.5	8.1	DIRECT [25]
EDA-PSO	**2.3**	3.4	3.6	6.7	4.5	4.9	5.1	5.3	5.6	6.1	EDA-PSO [6]
full NEWUOA	**1.9**	**1.3**	**1.2**	5.2	9.1	8.7	8.4	8.3	8.1	7.5	full NEWUOA [31]
G3-PCX	**1.5**	**2.8**	3.5	17	22	21	21	20	20	19	G3-PCX [26]
simple GA	3.2	4.3	5.1	14	7.1	10	14	17	21	29	simple GA [22]
GLOBAL	**1.3**	**2.7**	3.4	6.0	18	17	17	16	16	15	GLOBAL [23]
iAMaLGaM IDEA	**2.3**	**2.9**	3.7	16	19	18	18	18	17	16	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.7**	**2.1**	**2.8**	7.9	5.5	5.5	5.4	5.5	5.4	5.2	IPOP-SEP-CMA-ES [29]
LSfminbnd	6.4	6.1	6.8	10	*42e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	150	178	217	28	184	177	171	169	166	155	LSstep [28]
MA-LS-Chain	**2.5**	**2.3**	**2.8**	**2.5**	**1**	**1**	**1**	**1**	**1**	**1**	MA-LS-Chain [21]
MCS	**2.9**	**2.2**	**2.3**	3.2	**3.5**	**3.4**	**3.3**	**3.2**	**3.1**	**2.9**	MCS [18]
NELDER (Han)	**1**	**1**	**1**	19	25	24	23	23	23	21	NELDER (Han) [16]
NELDER (Doe)	**1.5**	**1.5**	**1.7**	3.6	10	10	10	10	9.4	8.7	NELDER (Doe) [5]
NEWUOA	**1.6**	**1.4**	**1.3**	**1.1**	**3.9**	**3.7**	**3.6**	**3.5**	**3.4**	**3.2**	NEWUOA [31]
(1+1)-ES	**2.2**	3.1	3.1	4.7	10	9.1	8.8	8.7	8.5	7.9	(1+1)-ES [1]
POEMS	109	87	84	7.4	65	63	63	69	69	66	POEMS [20]
PSO	**1.4**	3.2	3.7	**2.6**	22	22	21	21	21	20	PSO [7]
PSO_Bounds	**2.1**	**2.7**	3.2	5.2	52	78	76	85	84	80	PSO_Bounds [8]
Monte Carlo	**1.3**	**2.6**	3.1	56	1553	*94e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**3.0**	**2.6**	**2.5**	**1.5**	10	10	9.2	9.1	8.9	8.3	Rosenbrock [27]
VNS (Garcia)	3.7	**2.8**	**2.9**	4.4	5.5	5.3	5.1	5.1	5.2	5.8	VNS (Garcia) [11]

Table 45: Running time excess ERT/ERT_{best} on f_{21} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.33	0.33	2.0	61	142	146	153	155	156	161	ERT_{best}/D
ALPS-GA	**1**	**1**	**1.3**	**2.3**	3.7	5.8	7.4	8.8	11	15	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**2.2**	17	41	41	40	40	40	39	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**2.1**	7.5	94	*63e-2 /2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.7**	6.8	6.0	6.1	6.0	6.0	6.1	6.1	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	**2.1**	3.3	3.5	3.4	3.3	3.3	3.2	3.2	BFGS [30]
Cauchy EDA	**1**	**1**	16	11	244	238	499	652	887	864	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	**1.9**	4.5	8.1	8.0	7.7	7.6	7.5	7.4	(1+1)-CMA-ES [2]
DASA	**1**	**1**	12	93	66	65	62	62	62	61	DASA [19]
DEPSO	**1**	**1**	**1.2**	4.1	3.5	4.6	5.3	6.6	7.1	7.5	DEPSO [12]
DIRECT	**1**	**1**	**1.9**	**1**	**1.4**	**1.4**	**1.4**	3.8	4.2	5.8	DIRECT [25]
EDA-PSO	**1**	**1**	**1.4**	3.2	54	55	58	59	62	65	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.4**	3.3	**2.8**	**2.7**	**2.6**	**2.6**	**2.6**	**2.6**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.6**	8.6	5.7	5.6	5.4	5.4	5.4	5.4	G3-PCX [26]
simple GA	**1**	**1**	**1.5**	**2.5**	5.3	18	29	43	99	229	simple GA [22]
GLOBAL	**1**	**1**	**1.8**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.6**	28	20	19	19	18	18	18	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1.0**	4.6	15	17	17	17	17	17	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	6.1	21	27	26	31	38	39	46	LSfminbnd [28]
LSstep	**1**	**1**	15	210	195	193	191	196	203	217	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.7**	**1.7**	10	10	10	10	10	10	MA-LS-Chain [21]
MCS	**1**	**1**	6.2	**2.1**	4.4	4.3	4.1	4.1	4.1	4.2	MCS [18]
NELDER (Han)	**1**	**1**	**1.6**	16	26	25	24	23	23	23	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.0**	**2.8**	**2.9**	**2.8**	**2.7**	**2.7**	**2.7**	**2.6**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.6**	**2.7**	3.5	3.5	3.4	3.4	3.4	3.4	NEWUOA [31]
(1+1)-ES	**1**	**1**	**2.0**	15	17	17	16	16	16	16	(1+1)-ES [1]
POEMS	**1**	**1**	95	675	551	537	514	511	511	504	POEMS [20]
PSO	**1**	**1**	**1.2**	120	111	108	104	103	103	102	PSO [7]
PSO_Bounds	**1**	**1**	**1**	120	178	175	169	170	170	170	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.5**	**2.9**	8.3	34	120	983	4465	*62e-7/1e6*	Monte Carlo [3]
Rosenbrock	**1**	**1**	17	8.1	12	11	11	11	11	11	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.1**	9.2	11	11	11	11	11	11	VNS (Garcia) [11]

Table 46: Running time excess ERT/ERT$_{\text{best}}$ on f_{22} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.33	0.33	6.0	57	118	121	128	132	134	138	ERT$_{\text{best}}$/D
ALPS-GA	**1**	**1**	**1.8**	**2.1**	4.0	8.5	12	17	21	28	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.1**	21	56	61	59	58	57	57	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**2.0**	11	48	*36e-2/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.1**	6.4	13	14	13	13	13	13	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	3.3	**2.6**	**2.1**	**2.1**	**2.0**	**2.0**	**2.0**	**2.0**	BFGS [30]
Cauchy EDA	**1**	**1**	12	229	644	1144	2543	2475	2433	2358	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	3.5	6.8	11	10	10	10	10	9.4	(1+1)-CMA-ES [2]
DASA	**1**	**1**	20	100	69	75	79	88	98	117	DASA [19]
DEPSO	**1**	**1**	4.8	4.7	13	14	14	18	26	34	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	**1**	6.3	6.2	7.4	10	15	18	DIRECT [25]
EDA-PSO	**1**	**1**	**1.2**	3.9	5.4	11	16	22	29	42	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.3**	**2.0**	**1.8**	**1.9**	**1.9**	**1.9**	**1.9**	**2.1**	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.4**	4.1	10	10	10	10	10	10	G3-PCX [26]
simple GA	**1**	**1**	**1**	3.5	6.5	27	273	953	1591	3083	simple GA [22]
GLOBAL	**1**	**1**	**1.6**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.6**	21	43	44	43	42	43	42	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1.7**	3.9	13	31	30	30	29	29	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	14	13	19	66	62	70	77	150	LSfminbnd [28]
LSstep	**1**	**1**	64	48	155	240	321	*16e-2/1e4*	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.4**	3.7	**2.7**	3.3	3.4	3.5	3.8	4.3	MA-LS-Chain [21]
MCS	**1**	**1**	3.3	**1.6**	**1.2**	**1.2**	4.6	4.6	4.5	4.6	MCS [18]
NELDER (Han)	**1**	**1**	5.5	10	13	13	12	12	12	12	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	4.1	**2.0**	**2.2**	**2.2**	**2.1**	**2.0**	**2.0**	**2.0**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.8**	**2.5**	5.8	5.8	5.6	5.5	5.5	5.7	NEWUOA [31]
(1+1)-ES	**1**	**1**	23	17	17	17	17	18	19	20	(1+1)-ES [1]
POEMS	**1**	**1**	42	167	453	447	424	416	411	405	POEMS [20]
PSO	**1**	**1**	**1.1**	127	132	130	124	123	122	123	PSO [7]
PSO_Bounds	**1**	**1**	**1.5**	**2.2**	64	65	67	69	76	88	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.7**	**3.0**	4.8	40	202	1460	7143	*30e-7/1e6*	Monte Carlo [3]
Rosenbrock	**1**	**1**	**1.7**	5.6	5.2	5.3	5.1	5.1	5.1	5.0	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**1.4**	10	12	13	13	14	14	15	VNS (Garcia) [11]

Table 47: Running time excess ERT/ERT$_{\text{best}}$ on f_{23} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.33	0.33	0.87	136	302	405	738	751	764	798	ERT$_{\text{best}}$/D
ALPS-GA	**1**	**1**	3.7	12	54	205	374	891	6271	30109	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	3.9	6.3	10	8.9	5.1	5.1	5.1	5.1	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	3.2	34	*11e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	4.9	6.4	9.3	7.1	4.2	4.2	4.2	4.2	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	17	8.7	112	*23e-2/5e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	4.1	52	*51e-2/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	3.7	**2.0**	11	17	12	12	12	12	(1+1)-CMA-ES [2]
DASA	**1**	**1**	15	71	884	1735	1852	5361	5268	5051	DASA [19]
DEPSO	**1**	**1**	**1.9**	40	*12e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	4.7	**1.5**	31	25	15	16	18	22	DIRECT [25]
EDA-PSO	**1**	**1**	**2.9**	23	4943	3689	2030	*31e-2/1e5*	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	6.7	**2.4**	15	40	37	169	166	159	full NEWUOA [31]
G3-PCX	**1**	**1**	4.9	**2.1**	14	29	17	30	43	42	G3-PCX [26]
simple GA	**1**	**1**	4.3	16	522	3700	*88e-3/1e5*	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	3.1	**1.6**	**3.1**	*81e-3/1e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	4.4	8.4	10	7.5	4.3	4.3	4.3	4.3	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	4.6	7.1	13	11	5.9	5.9	5.9	5.8	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	3.2	7.1	418	*31e-2/9e3*	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	5.6	4.9	488	*25e-2/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	4.1	**2.1**	6.7	**5.2**	**2.9**	**3.1**	**3.1**	**3.1**	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**2.7**	12	39	326	*77e-4/2e4*	.	.	MCS [18]
NELDER (Han)	**1**	**1**	3.1	**1.4**	**2.3**	**1.8**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	6.7	**1**	**1**	**1**	**1.1**	**1.4**	**1.4**	**1.4**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	11	**2.7**	24	109	*68e-3/6e3*	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	21	**2.9**	13	238	506	1482	1771	3540	(1+1)-ES [1]
POEMS	**1**	**1**	18	22	126	128	73	75	76	79	POEMS [20]
PSO	**1**	**1**	3.2	11	168	363	201	202	200	194	PSO [7]
PSO_Bounds	**1**	**1**	**1.9**	15	462	570	445	445	927	890	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.6**	13	23003	*13e-2/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**2.4**	**1.9**	10	88	48	*31e-3/5e3*	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	4.6	6.7	27	41	23	23	24	23	VNS (Garcia) [11]

Table 48: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{24} in **3-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.33	0.33	32	3464	34218	1.19e5	1.19e5	1.19e5	1.19e5	1.19e5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.1**	7.9	3.5	**6.2**	**2.9**	**2.9**	**3.0**	**3.0**	**3.1**	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.2**	**1.5**	10	10	4.5	4.6	4.7	4.7	5.1	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.3**	4.3	*40e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.3**	7.6	7.9	3.0	4.1	4.9	4.9	4.9	BIPOP-CMA-ES [15]
BFGS	**1**	**1.8**	9.3	*41e-1/3e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.1**	**1.7**	4.2	104	*31e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	9.2	3.3	*91e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	69	85	419	*37e-2/1e6*	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	5.8	*48e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.5**	39	*30e-1/3e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.2**	6.4	*30e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.7**	**2.8**	**1.2**	*76e-2/6e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	19	22	10	*10e-1/5e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.1**	18	*32e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	3.4	**1.1**	*27e-1/2e3*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.5**	5.3	5.8	10	8.7	8.7	8.7	8.7	8.8	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1**	5.0	*13e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.1**	**1.9**	6.4	*12e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	3.0	3.1	6.5	41	*35e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	3.7	*30e-1/2e4*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	17	**2.0**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1**	**1**	20	5.2	10	6.3	6.3	6.3	6.3	6.3	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.3**	**1.5**	**3.9**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	NELDER (Doe) [5]
NEWUOA	**1**	**1.5**	**2.5**	**1**	*45e-2/6e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**2.5**	23	13	40	124	124	124	124	124	(1+1)-ES [1]
POEMS	**1**	58	16	86	42	12	12	12	12	12	POEMS [20]
PSO	**1**	**1**	4.7	405	*31e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.1**	9.1	411	42	12	12	12	12	12	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	10	450	*10e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.1**	54	*36e-1/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.6**	**2.9**	**1.6**	106	64	64	64	65	114	VNS (Garcia) [11]

Table 49: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_1 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.20	0.20	2.2	2.4	2.4	2.4	2.4	2.4	2.4	2.4	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.6**	9.2	138	299	490	682	847	1033	1412	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.5**	5.5	16	29	44	58	72	87	119	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.2**	5.2	46	92	128	174	283	393	560	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.1**	3.2	9.0	15	21	27	33	40	53	BIPOP-CMA-ES [15]
BFGS	**1**	3.4	**1.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	BFGS [30]
Cauchy EDA	**1**	24	41	90	171	243	315	395	463	604	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.3**	**2.3**	5.9	10	14	17	21	25	32	(1+1)-CMA-ES [2]
DASA	**1**	5.2	23	44	59	71	88	109	120	150	DASA [19]
DEPSO	**1**	**1.3**	8.1	26	48	77	110	133	166	222	DEPSO [12]
DIRECT	**1**	**1**	**2.0**	7.0	19	31	44	62	84	153	DIRECT [25]
EDA-PSO	**1**	**1.1**	3.2	20	319	886	1499	2095	2689	3835	EDA-PSO [6]
full NEWUOA	**1**	**2.9**	**1.9**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	full NEWUOA [31]
G3-PCX	**1**	**1.5**	5.2	12	15	19	25	31	35	45	G3-PCX [26]
simple GA	**1**	**1.5**	8.7	362	1182	2095	2940	4138	5384	8329	simple GA [22]
GLOBAL	**1**	**1.3**	6.8	26	28	30	32	33	35	39	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	**2.5**	10	19	28	36	47	56	73	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.5**	**2.8**	7.0	14	18	23	29	34	44	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**2.8**	6.0	6.3	6.7	6.7	6.8	6.8	6.8	6.8	LSfminbnd [28]
LSstep	**1**	135	92	121	129	132	132	132	132	132	LSstep [28]
MA-LS-Chain	**1**	**1.3**	7.8	25	47	60	74	90	119	143	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1.8**	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	MCS [18]
NELDER (Han)	**1**	**1.7**	**1.5**	3.3	5.4	7.2	9.2	11	13	17	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.3**	**1.5**	3.4	5.6	7.4	9.5	11	13	17	NELDER (Doe) [5]
NEWUOA	**1**	**2.4**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1.2**	**2.3**	5.0	8.4	11	15	18	22	28	(1+1)-ES [1]
POEMS	**1**	241	106	128	377	757	1151	1624	2083	2908	POEMS [20]
PSO	**1**	**1.3**	3.7	22	55	115	182	238	317	450	PSO [7]
PSO_Bounds	**1**	**1.2**	3.8	41	213	433	733	984	1318	1947	PSO_Bounds [8]
Monte Carlo	**1**	**1.4**	7.5	1670	6.77e5	*10e-2/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**2.9**	**2.9**	4.2	5.5	6.8	8.7	10	12	15	Rosenbrock [27]
VNS (Garcia)	**1**	**1.6**	7.4	18	25	31	38	45	50	64	VNS (Garcia) [11]

Table 50: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_2 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	10	15	17	17	18	18	18	18	18	19	$\mathrm{ERT_{best}}$/D
ALPS-GA	45	55	73	95	120	146	165	187	214	256	ALPS-GA [17]
AMaLGaM IDEA	5.2	5.3	7.1	10	13	15	17	19	21	24	AMaLGaM IDEA [4]
BayEDAcG	32	38	41	46	52	58	64	79	84	95	BayEDAcG [10]
BIPOP-CMA-ES	11	11	13	16	18	19	20	20	21	22	BIPOP-CMA-ES [15]
BFGS	3.3	3.4	**3.8**	**5.6**	**6.2**	**6.5**	**6.6**	**6.8**	**6.9**	**7.1**	BFGS [30]
Cauchy EDA	35	35	42	49	58	71	80	91	101	120	Cauchy EDA [24]
(1+1)-CMA-ES	5.6	6.6	9.4	11	12	13	14	14	14	15	(1+1)-CMA-ES [2]
DASA	10	8.6	10	12	13	15	17	19	21	26	DASA [19]
DEPSO	11	11	13	16	21	24	28	32	37	44	DEPSO [12]
DIRECT	4.2	4.3	5.7	7.2	8.4	10	14	16	22	381	DIRECT [25]
EDA-PSO	8.6	58	136	205	286	358	421	494	554	694	EDA-PSO [6]
full NEWUOA	**1.5**	**2.7**	6.9	19	36	50	69	87	103	134	full NEWUOA [31]
G3-PCX	15	30	69	154	222	275	340	413	471	624	G3-PCX [26]
simple GA	184	229	333	456	606	769	1304	1521	2158	2530	simple GA [22]
GLOBAL	7.1	5.4	6.3	6.9	7.3	7.5	7.8	8.0	8.2	**8.5**	GLOBAL [23]
iAMaLGaM IDEA	4.4	4.7	6.2	8.1	10	12	13	14	15	17	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	5.4	5.7	7.2	8.5	9.4	10	11	11	12	13	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1.5**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	25	17	16	16	16	15	15	15	15	15	LSstep [28]
MA-LS-Chain	7.9	10	13	16	22	27	32	36	41	49	MA-LS-Chain [21]
MCS	**1.3**	**1**	**1.1**	**1.5**	**2.2**	**3.2**	**4.7**	**5.7**	**6.5**	29	MCS [18]
NELDER (Han)	**2.4**	**2.7**	5.0	6.8	7.4	7.7	7.9	8.1	8.3	8.6	NELDER (Han) [16]
NELDER (Doe)	**2.0**	**2.5**	4.9	8.1	8.9	9.3	10	10	10	10	NELDER (Doe) [5]
NEWUOA	**1**	**1.8**	5.7	22	45	60	85	105	129	166	NEWUOA [31]
(1+1)-ES	112	1593	5551	15735	30378	46226	1.86e5	2.59e5	8.05e5	*19e-4/1e6*	(1+1)-ES [1]
POEMS	145	164	215	273	331	381	438	466	519	628	POEMS [20]
PSO	19	25	32	41	49	59	68	78	89	105	PSO [7]
PSO_Bounds	47	83	155	194	257	303	397	591	861	1179	PSO_Bounds [8]
Monte Carlo	1806	1.23e5	*11e+1/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.2**	8.6	13	102	136	138	153	188	188	241	Rosenbrock [27]
VNS (Garcia)	15	14	18	20	24	24	25	26	26	27	VNS (Garcia) [11]

Table 51: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_3 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.20	2.9	143	324	327	328	329	330	330	331	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1.5**	**2.0**	5.7	12	22	24	26	28	29	33	ALPS-GA [17]
AMaLGaM IDEA	**1.5**	**2.1**	4.5	65	484	505	514	518	520	524	AMaLGaM IDEA [4]
BayEDAcG	**1.2**	**1.7**	**2.7**	*29e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.5	**1.5**	**1.4**	16	139	139	139	139	139	140	BIPOP-CMA-ES [15]
BFGS	7.4	56	107	*21e+0/4e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	35	25	6.7	2244	*26e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**2.2**	**1.3**	9.1	440	*30e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	8.7	18	**1.2**	**1.6**	**10**	**10**	**10**	**10**	**10**	**11**	DASA [19]
DEPSO	**1.4**	**2.9**	3.7	29	30	30	30	*23e-1/2e3*	.	.	DEPSO [12]
DIRECT	**1**	**2.6**	45	304	*30e-1/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.4**	**2.2**	12	170	856	857	860	863	866	870	EDA-PSO [6]
full NEWUOA	4.3	3.7	4.2	164	*20e-1/7e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**2.0**	3.0	84	2052	*30e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	**1.6**	19	18	25	34	43	53	112	200	simple GA [22]
GLOBAL	**1.2**	**2.4**	3.3	*50e-1/500*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	**1.4**	**1.4**	33	178	182	184	185	187	189	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.2**	**2.3**	**1.2**	12	96	96	96	97	97	97	IPOP-SEP-CMA-ES [29]
LSfminbnd	11	**2.7**	**1**	52	*21e-1/4e3*	.	.	.	.	.	LSfminbnd [28]
LSstep	81	62	**2.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1**	**1.3**	**1.0**	6.4	32	32	32	32	32	**32**	MA-LS-Chain [21]
MCS	**1**	**1**	**1.2**	24	216	215	215	214	214	214	MCS [18]
NELDER (Han)	**1**	**1.3**	5.4	282	1464	1460	1456	1454	1452	1449	NELDER (Han) [16]
NELDER (Doe)	**2.1**	**1.0**	**1.5**	33	268	268	267	266	266	266	NELDER (Doe) [5]
NEWUOA	3.0	**1.5**	6.1	229	*40e-1/5e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1.8**	**2.3**	16	308	3859	3848	3839	3832	3829	3821	(1+1)-ES [1]
POEMS	170	70	3.8	10	35	39	42	45	47	54	POEMS [20]
PSO	**1.4**	**1.7**	52	55	275	275	275	275	276	276	PSO [7]
PSO_Bounds	**1.5**	**1.6**	7.6	26	38	63	64	65	70	95	PSO_Bounds [8]
Monte Carlo	**1**	**2.1**	6763	*83e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	5.7	39	24	394	*70e-1/9e3*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1.6**	**2.5**	**2.5**	**5.2**	**11**	**11**	**12**	**16**	**22**	40	VNS (Garcia) [11]

Table 52: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_4 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.20	3.8	162	327	338	352	363	370	377	381	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1.1**	4.4	7.1	28	59	58	58	58	59	63	ALPS-GA [17]
AMaLGaM IDEA	**1.8**	3.4	5.8	20244	*20e-1/1e6*	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	**1.7**	6.3	5.8	*69e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.1**	**2.9**	**2.7**	*20e-1/4e5*	.	.	.	.	.	.	BIPOP-CMA-ES [15]
BFGS	3.0	67	169	*24e+0/4e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	7.6	39	85	*78e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.6**	15	458	*30e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	15	13	**1.0**	**1.8**	**5.9**	**5.7**	**5.6**	**5.6**	**5.7**	**5.9**	DASA [19]
DEPSO	**1.8**	5.2	3.3	*30e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**2.5**	192	105	249	*11e+0/2e4*	.	.	.	.	DIRECT [25]
EDA-PSO	**1.1**	3.5	14	2011	*20e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	3.9	**2.8**	12	*30e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.5**	4.6	76	2150	*50e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1.9**	5.0	18	20	**26**	**33**	41	49	58	185	simple GA [22]
GLOBAL	**1.3**	4.9	8.3	*11e+0/600*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.7**	**2.3**	3.9	21028	*20e-1/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.5**	**2.1**	**1**	*37e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	21	3.0	7.8	*42e-1/5e3*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	322	58	**2.0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1.5**	3.8	**1.7**	35	176	169	163	161	158	157	MA-LS-Chain [21]
MCS	**1**	**2.3**	4.1	*20e-1/1e4*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	3.1	**1.4**	26	*30e-1/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.9**	**1**	7.1	898	870	835	808	793	779	772	NELDER (Doe) [5]
NEWUOA	4.1	27	27	305	*60e-1/7e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	3.3	**2.0**	25	3740	20218	19414	18780	18440	18097	17932	(1+1)-ES [1]
POEMS	212	67	4.5	17	45	47	47	**49**	**52**	**57**	POEMS [20]
PSO	**1.7**	**2.7**	**3.0**	141	4152	3988	3859	3789	3720	3687	PSO [7]
PSO_Bounds	**1.6**	3.2	8.0	30	64	115	113	113	113	135	PSO_Bounds [8]
Monte Carlo	**1.3**	3.4	15603	*12e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	5.1	33	57	*99e-1/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**2.0**	5.6	**2.5**	**16**	39	38	**39**	50	54	128	VNS (Garcia) [11]

Table 53: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_5 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.20	0.29	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	**1.5**	64	132	159	162	165	165	165	165	ALPS-GA [17]
AMaLGaM IDEA	**1**	**2.0**	19	28	29	29	29	29	29	29	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.7**	38	76	321	321	323	323	323	323	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.5**	4.5	6.5	6.6	6.6	6.6	6.6	6.6	6.6	BIPOP-CMA-ES [15]
BFGS	**1**	5.9	**1.9**	**3.0**	3.1	3.1	3.1	3.1	3.1	3.1	BFGS [30]
Cauchy EDA	**1**	29	39	41	41	41	41	41	41	41	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**2.0**	**2.3**	3.1	3.2	3.2	3.2	3.2	3.2	3.2	(1+1)-CMA-ES [2]
DASA	**1**	45	28	36	40	43	49	52	55	63	DASA [19]
DEPSO	**1**	**2.0**	22	37	41	41	41	41	41	41	DEPSO [12]
DIRECT	**1**	4.5	9.2	12	13	13	13	13	13	13	DIRECT [25]
EDA-PSO	**1**	**1**	10	16	16	16	16	17	17	17	EDA-PSO [6]
full NEWUOA	**1**	**1.5**	**2.2**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	full NEWUOA [31]
G3-PCX	**1**	**1.8**	14	25	27	28	28	28	28	28	G3-PCX [26]
simple GA	**1**	**1.9**	481	2072	3983	6349	9220	12341	16672	34214	simple GA [22]
GLOBAL	**1**	**2.3**	32	33	34	34	34	34	34	34	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	7.1	11	12	12	12	12	12	12	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	5.7	4.8	6.6	6.8	6.9	6.9	6.9	6.9	6.9	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	18	13	14	14	14	14	14	14	14	LSfminbnd [28]
LSstep	**1**	183	141	160	160	160	160	160	160	160	LSstep [28]
MA-LS-Chain	**1**	**1.5**	53	69	70	71	71	71	71	71	MA-LS-Chain [21]
MCS	**1**	3.0	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1**	3.9	**2.5**	4.1	4.2	4.2	4.2	4.2	4.2	4.2	NELDER (Han) [16]
NELDER (Doe)	**1**	3.1	**1.9**	**2.4**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	NELDER (Doe) [5]
NEWUOA	**1**	**2.9**	**1.3**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	NEWUOA [31]
(1+1)-ES	**1**	3.0	**2.0**	**2.4**	**2.5**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	(1+1)-ES [1]
POEMS	**1**	345	155	197	213	221	222	223	223	223	POEMS [20]
PSO	**1**	**1.7**	10	14	16	16	16	16	16	16	PSO [7]
PSO_Bounds	**1**	**1.6**	9.2	15	16	16	16	16	16	16	PSO_Bounds [8]
Monte Carlo	**1**	**1.6**	4349	*37e-1 /1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	11	4.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	Rosenbrock [27]
VNS (Garcia)	**1**	**2.2**	13	15	15	15	15	15	15	15	VNS (Garcia) [11]

Table 54: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_6 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	2.3	3.2	23	43	56	81	116	149	208	266	$\mathrm{ERT_{best}}$/D
ALPS-GA	31	32	20	28	40	41	39	39	34	37	ALPS-GA [17]
AMaLGaM IDEA	6.6	5.7	3.2	4.3	5.7	5.7	5.2	5.0	4.3	4.5	AMaLGaM IDEA [4]
BayEDAcG	8.8	10	247	*13e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.5**	5.2	**2.3**	**2.1**	**2.2**	**1.9**	**1.7**	**1.6**	**1.3**	**1.3**	BIPOP-CMA-ES [15]
BFGS	**2.9**	4.9	3.0	3.3	3.4	**3.0**	**2.5**	**2.3**	**2.0**	7.8	BFGS [30]
Cauchy EDA	49	227	92	69	68	58	47	43	35	34	Cauchy EDA [24]
(1+1)-CMA-ES	**1.6**	3.3	**1.4**	**1.4**	**1.6**	**1.7**	**1.6**	**1.5**	**1.6**	**1.8**	(1+1)-CMA-ES [2]
DASA	21	21	7.8	9.0	50	99	108	101	81	150	DASA [19]
DEPSO	6.3	8.3	5.5	6.4	8.0	8.0	7.1	7.0	6.3	10	DEPSO [12]
DIRECT	**2.5**	**2.2**	**2.3**	28	789	1220	*22e-2/2e4*	.	.	.	DIRECT [25]
EDA-PSO	5.0	4.9	11	51	81	85	79	75	65	68	EDA-PSO [6]
full NEWUOA	**1.5**	3.6	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1.4**	full NEWUOA [31]
G3-PCX	7.2	7.1	**2.4**	**3.0**	4.8	5.1	4.7	5.6	5.1	5.5	G3-PCX [26]
simple GA	60	81	66	148	381	3683	12303	9658	*24e-3/1e5*	.	simple GA [22]
GLOBAL	12	10	**2.9**	**2.1**	**2.0**	**2.9**	**2.2**	**2.7**	3.6	35	GLOBAL [23]
iAMaLGaM IDEA	**3.0**	3.6	**2.1**	**2.3**	3.1	3.1	**2.7**	**2.6**	**2.2**	**2.3**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.4**	7.0	**2.8**	**2.5**	**2.7**	**2.4**	**2.2**	**2.0**	**1.6**	**1.5**	IPOP-SEP-CMA-ES [29]
LSfminbnd	9.1	14	96	115	135	155	110	113	82	65	LSfminbnd [28]
LSstep	161	199	408	292	296	418	604	487	*21e-2/1e4*	.	LSstep [28]
MA-LS-Chain	12	11	4.8	6.8	7.9	7.4	5.8	5.1	4.1	3.7	MA-LS-Chain [21]
MCS	**1**	**1**	**2.7**	47	41	61	71	63	46	54	MCS [18]
NELDER (Han)	**1.7**	**2.4**	**1**	**1.9**	**2.8**	**2.6**	**2.3**	**2.3**	**2.0**	**2.6**	NELDER (Han) [16]
NELDER (Doe)	**2.3**	11	5.1	5.6	5.6	4.9	5.3	6.6	5.6	8.5	NELDER (Doe) [5]
NEWUOA	**1.4**	**2.8**	**1.7**	**2.4**	3.6	3.6	3.3	3.2	**2.7**	**2.9**	NEWUOA [31]
(1+1)-ES	**1.7**	3.4	**1.6**	**1.5**	**1.7**	**1.5**	**1.3**	**1.2**	**1.0**	**1**	(1+1)-ES [1]
POEMS	95	80	27	46	52	50	46	42	37	37	POEMS [20]
PSO	5.2	5.3	4.7	9.0	11	12	11	12	10	11	PSO [7]
PSO_Bounds	4.4	4.4	14	49	85	105	98	92	78	92	PSO_Bounds [8]
Monte Carlo	287	475	303	56969	*14e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**3.0**	**2.6**	**2.2**	**2.8**	**2.4**	**2.2**	4.3	3.8	**2.8**	**2.4**	Rosenbrock [27]
VNS (Garcia)	7.7	12	3.7	**2.7**	**2.9**	**2.5**	**2.0**	**1.8**	**1.5**	**1.4**	VNS (Garcia) [11]

Table 55: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_7 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.20	1.2	4.7	65	234	290	314	314	314	319	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.1**	**2.3**	33	10	5.7	7.7	9.0	9.0	9.0	10	ALPS-GA [17]
AMaLGaM IDEA	**1.3**	**2.8**	5.6	**1**	**1.2**	**1.8**	**2.3**	**2.3**	**2.3**	**2.4**	AMaLGaM IDEA [4]
BayEDAcG	**1.5**	**2.4**	20	31	121	99	*73e-2/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.7**	**2.2**	5.0	**1.5**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	3.0	14	*32e+0/100*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	10	31	33	4.9	**2.4**	**2.9**	**2.9**	**2.9**	**2.9**	3.4	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.6**	3.5	5.3	**2.0**	**2.1**	3.1	3.1	3.1	3.1	(1+1)-CMA-ES [2]
DASA	24	43	225	281	1108	20196	*16e-3/8e5*	.	.	.	DASA [19]
DEPSO	**1.2**	6.5	14	**3.0**	5.0	7.2	8.3	8.3	8.3	8.5	DEPSO [12]
DIRECT	**1**	**1**	**2.8**	**1.7**	115	*41e-3/2e4*	.	.	.	.	DIRECT [25]
EDA-PSO	**1.3**	**1.7**	22	24	13	17	18	18	18	19	EDA-PSO [6]
full NEWUOA	**1.7**	3.3	**1**	**1.2**	4.0	14	24	24	24	23	full NEWUOA [31]
G3-PCX	**1.3**	**2.5**	19	18	45	152	415	415	415	409	G3-PCX [26]
simple GA	**1.4**	3.5	50	35	57	245	524	524	524	523	simple GA [22]
GLOBAL	**1.6**	**2.9**	12	5.7	10	*82e-2/400*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	**2.3**	3.8	**1.9**	**3.0**	**2.9**	3.7	3.7	3.7	3.7	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.1**	**2.5**	6.0	**1.8**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	IPOP-SEP-CMA-ES [29]
LSfminbnd	3.8	17	49	64	100	511	*40e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	28	186	374	697	640	*19e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	3.5	8.4	3.2	13	13	24	24	24	24	MA-LS-Chain [21]
MCS	**1**	**1.3**	**2.8**	5.9	13	141	*25e-3/1e4*	.	.	.	MCS [18]
NELDER (Han)	**1.1**	**1.6**	27	33	56	119	307	307	307	302	NELDER (Han) [16]
NELDER (Doe)	**1.4**	**1.3**	**1.4**	7.5	15	39	71	71	71	71	NELDER (Doe) [5]
NEWUOA	**1.5**	**2.2**	10	13	60	*32e-2/6e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1.9**	**2.6**	5.6	6.8	100	372	807	807	807	794	(1+1)-ES [1]
POEMS	396	181	74	15	9.2	11	21	21	21	22	POEMS [20]
PSO	**1.1**	4.0	11	9.5	587	475	541	541	541	533	PSO [7]
PSO_Bounds	**1.3**	**2.3**	9.4	13	165	140	131	131	131	129	PSO_Bounds [8]
Monte Carlo	**1.3**	**2.9**	39	1207	*38e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	11	222	1200	669	*13e+0/3e3*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	3.5	11	**1.6**	6.8	6.6	7.8	7.8	7.8	7.8	VNS (Garcia) [11]

Table 56: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_8 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	3.6	8.8	15	55	67	74	78	80	82	84	$\mathrm{ERT_{best}}$/D
ALPS-GA	11	32	51	49	104	146	177	210	253	341	ALPS-GA [17]
AMaLGaM IDEA	3.1	4.3	5.2	6.1	7.7	8.1	8.5	8.9	9.1	10	AMaLGaM IDEA [4]
BayEDAcG	5.5	11	135	*45e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.7**	3.6	3.2	3.7	4.5	4.7	4.8	5.0	5.1	5.4	BIPOP-CMA-ES [15]
BFGS	**2.1**	**2.4**	**2.1**	**1.8**	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	BFGS [30]
Cauchy EDA	24	32	49	31	33	33	34	36	37	40	Cauchy EDA [24]
(1+1)-CMA-ES	**2.1**	**2.1**	**2.1**	5.1	5.0	4.9	4.9	4.9	4.9	5.0	(1+1)-CMA-ES [2]
DASA	16	21	19	162	386	699	1046	1483	1995	3322	DASA [19]
DEPSO	4.7	7.2	12	18	*23e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**2.5**	**2.8**	4.1	5.7	22	56	100	149	195	293	DIRECT [25]
EDA-PSO	3.7	10	72	103	195	296	403	518	625	838	EDA-PSO [6]
full NEWUOA	**2.3**	**2.2**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	5.5	5.3	4.6	20	18	17	17	16	16	16	G3-PCX [26]
simple GA	8.4	114	186	837	*78e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	11	7.4	5.0	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.2**	GLOBAL [23]
iAMaLGaM IDEA	**2.3**	**2.8**	3.4	7.5	7.6	7.7	7.7	8.0	8.1	8.4	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.7**	**2.8**	3.5	5.8	6.8	6.7	6.8	6.8	6.9	7.1	IPOP-SEP-CMA-ES [29]
LSfminbnd	5.5	9.1	10	287	452	1903	*34e-1/1e4*	.	.	.	LSfminbnd [28]
LSstep	78	64	64	95	328	912	1826	1791	*53e-2/1e4*	.	LSstep [28]
MA-LS-Chain	5.8	7.3	8.7	7.2	10	10	11	11	11	12	MA-LS-Chain [21]
MCS	**1**	**1.4**	**1.5**	**1.0**	**1.0**	**1.0**	**1.1**	**1.1**	**1.1**	**1.1**	MCS [18]
NELDER (Han)	**1.3**	**1.6**	**1.6**	3.7	3.3	3.2	3.1	3.1	3.1	3.2	NELDER (Han) [16]
NELDER (Doe)	**1.1**	**2.3**	**2.1**	**2.4**	**2.4**	**2.3**	**2.3**	**2.3**	**2.4**	**2.4**	NELDER (Doe) [5]
NEWUOA	**1.0**	**1**	**1**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	NEWUOA [31]
(1+1)-ES	**2.7**	22	15	241	227	235	258	287	317	381	(1+1)-ES [1]
POEMS	67	40	69	181	200	386	745	2090	5485	17555	POEMS [20]
PSO	3.8	7.1	13	153	201	312	467	617	781	1103	PSO [7]
PSO_Bounds	5.1	12	30	468	920	1175	1409	3044	*12e-5/1e5*	.	PSO_Bounds [8]
Monte Carlo	10	219	20346	*64e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.3**	53	32	23	22	23	25	27	30	36	Rosenbrock [27]
VNS (Garcia)	8.9	5.9	5.1	6.6	7.7	21	46	48	47	46	VNS (Garcia) [11]

Table 57: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_9 in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.20	0.20	6.9	25	43	53	60	65	67	74	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	141	1129	91	92	134	197	259	309	374	561	ALPS-GA [17]
AMaLGaM IDEA	53	135	9.1	23	18	17	16	16	16	15	AMaLGaM IDEA [4]
BayEDAcG	81	349	38	*39e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	28	98	5.8	8.7	7.2	6.7	6.4	6.2	6.3	6.2	BIPOP-CMA-ES [15]
BFGS	31	84	3.6	**3.0**	**2.0**	**1.8**	**1.6**	**1.5**	**1.5**	**1.4**	BFGS [30]
Cauchy EDA	398	907	71	54	45	42	41	41	42	43	Cauchy EDA [24]
(1+1)-CMA-ES	30	86	4.2	7.7	5.9	5.3	5.0	4.9	4.9	4.7	(1+1)-CMA-ES [2]
DASA	333	7451	225	6694	4781	4576	4791	5333	6570	8879	DASA [19]
DEPSO	104	368	22	146	*10e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	3.2	4.2	48	56	134	140	151	306	DIRECT [25]
EDA-PSO	70	406	245	208	268	468	700	1143	1335	2849	EDA-PSO [6]
full NEWUOA	33	72	**2.6**	**2.7**	**1.9**	**1.7**	**1.5**	**1.5**	**1.4**	**1.3**	full NEWUOA [31]
G3-PCX	94	377	14	18	14	12	11	11	10	10	G3-PCX [26]
simple GA	101	3788	423	55818	*17e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	206	343	11	4.6	3.2	**3.0**	**2.8**	**2.7**	**2.7**	**2.7**	GLOBAL [23]
iAMaLGaM IDEA	42	123	7.0	22	15	14	13	12	12	12	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	43	225	10	11	10	8.8	8.3	8.0	8.0	7.7	IPOP-SEP-CMA-ES [29]
LSfminbnd	60	328	13	131	183	444	*25e-3/1e4*	.	.	.	LSfminbnd [28]
LSstep	2041	12850	519	5594	*19e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	84	257	18	20	17	17	17	16	16	16	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**13**	62	3.1	13	8.2	6.9	6.2	5.9	5.8	5.4	NELDER (Han) [16]
NELDER (Doe)	21	56	**2.4**	3.1	**2.5**	**2.3**	**2.1**	**2.1**	**2.1**	**2.0**	NELDER (Doe) [5]
NEWUOA	16	**28**	**1.8**	3.6	**2.5**	**2.1**	**1.9**	**1.9**	**1.9**	**1.7**	NEWUOA [31]
(1+1)-ES	29	64	**2.9**	103	80	99	128	162	201	266	(1+1)-ES [1]
POEMS	1221	1686	136	131	290	595	1053	1883	10862	*39e-6/1e5*	POEMS [20]
PSO	66	289	25	938	678	793	1129	1449	2361	2753	PSO [7]
PSO_Bounds	69	361	220	1460	1608	1838	3962	11324	21981	20176	PSO_Bounds [8]
Monte Carlo	178	12959	41460	*58e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	32	151	5.3	10	10	14	14	14	14	14	Rosenbrock [27]
VNS (Garcia)	60	246	11	18	14	12	11	11	11	10	VNS (Garcia) [11]

Table 58: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{10} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	21	34	70	100	115	121	125	129	166	176	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	29	54	88	316	888	1980	5263	19717	*21e-5/1e6*	.	ALPS-GA [17]
AMaLGaM IDEA	**2.7**	**2.6**	**1.9**	**1.9**	**2.0**	**2.3**	**2.5**	**2.7**	**2.3**	**2.6**	AMaLGaM IDEA [4]
BayEDAcG	398	842	*28e+2/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	5.1	5.1	3.5	**2.9**	**2.7**	**2.7**	**2.8**	**2.8**	**2.3**	**2.4**	BIPOP-CMA-ES [15]
BFGS	**1.7**	**1.5**	**1**	**1**	**1**	**1**	**1**	**1**	**1.1**	23	BFGS [30]
Cauchy EDA	16	16	11	9.0	9.4	11	12	13	11	13	Cauchy EDA [24]
(1+1)-CMA-ES	3.2	3.8	**2.5**	**2.2**	**2.0**	**2.1**	**2.1**	**2.1**	**1.7**	**1.7**	(1+1)-CMA-ES [2]
DASA	99	1126	6912	17511	38892	59348	1.16e5	1.13e5	89764	*47e-1/1e6*	DASA [19]
DEPSO	18	78	212	*88e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	8.8	57	110	141	281	*15e-2/2e4*	.	.	.	.	DIRECT [25]
EDA-PSO	71	129	886	1393	3929	11672	*21e-1/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	**1.0**	**2.0**	3.6	6.2	8.7	10	13	15	13	17	full NEWUOA [31]
G3-PCX	3.3	7.2	22	27	36	41	49	57	51	64	G3-PCX [26]
simple GA	131	501	2372	*15e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	3.8	**3.0**	**1.9**	**1.6**	**1.8**	**1.9**	**2.0**	**2.2**	**1.7**	**1.7**	GLOBAL [23]
iAMaLGaM IDEA	**2.2**	**2.2**	**1.8**	**1.6**	**1.7**	**1.9**	**2.0**	**2.2**	**1.8**	**2.0**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	10	12	7.4	5.6	5.1	5.0	5.0	5.0	4.0	3.9	IPOP-SEP-CMA-ES [29]
LSfminbnd	156	781	*25e+1/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	1191	*25e+2/1e4*	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.1	10	9.0	9.3	8.6	8.6	8.8	8.7	6.9	6.9	MA-LS-Chain [21]
MCS	53	113	277	*17e+0/1e4*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**1.1**	**1.2**	**1.4**	**1.3**	**1.4**	**1.4**	**1.5**	**1.5**	**1.2**	**1.2**	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1**	**1**	NELDER (Doe) [5]
NEWUOA	**1.5**	**2.6**	3.1	5.5	8.1	11	14	17	16	21	NEWUOA [31]
(1+1)-ES	34	125	698	2506	4461	5853	13876	57864	*67e-5/1e6*	.	(1+1)-ES [1]
POEMS	41	175	791	2484	*45e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	15	120	1739	3260	*10e+0/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	288	1172	3782	14964	*20e+0/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	993	47409	*10e+1/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	11	25	24	44	40	38	37	36	29	37	Rosenbrock [27]
VNS (Garcia)	6.6	6.2	4.5	3.5	3.4	3.4	3.5	3.5	**2.8**	**2.8**	VNS (Garcia) [11]

Table 59: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.5	4.9	29	40	153	195	235	270	293	335	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	15	23	54	340	299	536	807	1120	1807	22036	ALPS-GA [17]
AMaLGaM IDEA	4.5	5.4	**2.1**	**2.7**	**1**	**1**	**1**	**1.0**	**1.0**	**1.1**	AMaLGaM IDEA [4]
BayEDAcG	9.1	15	159	*15e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	6.4	15	8.4	7.2	**2.2**	**1.8**	**1.6**	**1.5**	**1.4**	**1.3**	BIPOP-CMA-ES [15]
BFGS	**2.1**	**1.8**	**1**	**1**	**1.1**	**1.9**	8.2	21	199	*32e-6/8e3*	BFGS [30]
Cauchy EDA	25	51	18	17	6.0	5.5	5.3	5.4	5.6	5.9	Cauchy EDA [24]
(1+1)-CMA-ES	4.0	7.0	6.5	6.6	**2.1**	**1.8**	**1.5**	**1.4**	**1.3**	**1.2**	(1+1)-CMA-ES [2]
DASA	11	12	1926	5203	2340	2814	3218	4179	9684	44641	DASA [19]
DEPSO	11	22	138	*10e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	5.8	15	87	2228	*19e-1/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	8.9	30	107	645	973	2424	6219	5510	*70e-3/1e5*	.	EDA-PSO [6]
full NEWUOA	**2.7**	20	11	14	5.4	4.9	5.3	5.5	5.9	6.5	full NEWUOA [31]
G3-PCX	7.6	7.9	55	110	45	44	49	52	56	61	G3-PCX [26]
simple GA	15	34	339	7131	9353	*21e-1/1e5*	.	.	.	.	simple GA [22]
GLOBAL	13	10	4.0	5.5	3.5	5.1	5.0	4.8	5.0	8.5	GLOBAL [23]
iAMaLGaM IDEA	6.1	6.6	3.4	**3.8**	**1.2**	**1.1**	**1.0**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	18	33	16	14	4.2	3.4	**2.9**	**2.6**	**2.5**	**2.2**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.7**	317	*61e+0/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	3.6	747	4909	*73e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.9	8.7	15	19	6.7	5.6	4.9	4.4	4.2	3.8	MA-LS-Chain [21]
MCS	**1**	**1**	82	461	*13e-1/1e4*	.	.	.	.	.	MCS [18]
NELDER (Han)	**2.9**	**2.7**	**3.2**	5.0	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	**1.6**	NELDER (Han) [16]
NELDER (Doe)	4.4	3.4	4.5	4.7	**1.5**	**1.4**	**1.2**	**1.2**	**1.1**	**1.2**	NELDER (Doe) [5]
NEWUOA	**1.7**	5.9	3.5	4.7	**1.8**	**1.7**	**1.8**	**1.8**	**2.0**	**2.2**	NEWUOA [31]
(1+1)-ES	**2.8**	6656	6399	9287	3730	3789	6673	27693	*90e-5/1e6*	.	(1+1)-ES [1]
POEMS	88	61	228	509	267	350	627	801	937	2184	POEMS [20]
PSO	8.2	13	91	236	123	140	164	189	243	391	PSO [7]
PSO_Bounds	7.2	21	429	1443	1008	1009	1076	1627	1522	1371	PSO_Bounds [8]
Monte Carlo	7.4	30	727	1.09e5	*11e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.2**	12	117	88	26	21	18	16	14	13	Rosenbrock [27]
VNS (Garcia)	11	34	11	8.7	**2.5**	**2.1**	**1.8**	**1.6**	**1.6**	**1.5**	VNS (Garcia) [11]

Table 60: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{12} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	13	16	22	54	74	83	92	233	261	299	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	100	124	126	167	539	1439	4213	13976	26851	*24e-5/1e6*	ALPS-GA [17]
AMaLGaM IDEA	8.8	9.2	10	6.7	8.6	10	11	4.9	5.1	5.2	AMaLGaM IDEA [4]
BayEDAcG	46	46	96	259	391	*71e-1/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	5.1	6.3	11	7.4	7.4	7.5	7.7	3.4	3.3	3.3	BIPOP-CMA-ES [15]
BFGS	**1.1**	**1**	**1.1**	**1**	**1**	**1**	**1**	**1.3**	**2.0**	49	BFGS [30]
Cauchy EDA	66	75	79	41	35	37	38	17	17	17	Cauchy EDA [24]
(1+1)-CMA-ES	**2.8**	3.4	4.0	**2.9**	3.5	3.9	4.1	**1.9**	**1.9**	**1.9**	(1+1)-CMA-ES [2]
DASA	17	17	11568	54091	59406	1.78e5	*32e-1/1e6*	.	.	.	DASA [19]
DEPSO	23	33	55	47	120	*95e-2/2e3*	.	.	.	.	DEPSO [12]
DIRECT	6.6	8.0	8.5	8.7	19	39	108	96	377	*21e-6/2e4*	DIRECT [25]
EDA-PSO	312	390	1075	2972	8928	*21e-1/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.5**	3.7	**2.6**	**2.7**	3.0	3.3	**1.6**	**1.6**	**1.7**	full NEWUOA [31]
G3-PCX	4.0	4.2	14	11	13	13	12	5.3	5.2	5.1	G3-PCX [26]
simple GA	518	616	931	2449	19255	*11e-1/1e5*	.	.	.	.	simple GA [22]
GLOBAL	5.6	5.0	4.6	**2.7**	**2.4**	3.0	5.0	**3.0**	3.1	3.4	GLOBAL [23]
iAMaLGaM IDEA	5.5	6.1	6.9	4.3	4.0	4.3	4.7	**2.1**	**2.1**	**2.3**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.6	6.2	12	11	9.1	8.7	8.6	3.7	3.5	3.3	IPOP-SEP-CMA-ES [29]
LSfminbnd	3.4	3.6	310	1215	1890	*68e-1/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	23	26	463	1237	*57e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	11	11	11	13	16	15	16	6.9	6.7	6.5	MA-LS-Chain [21]
MCS	**1.2**	**1.1**	**1**	18	17	15	22	22	26	56	MCS [18]
NELDER (Han)	**1.4**	**1.7**	**2.3**	**2.2**	**2.2**	**2.2**	**2.3**	**1**	**1**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1.6**	**2.4**	4.4	**2.9**	**2.7**	**2.7**	**2.7**	**1.2**	**1.1**	**1.2**	NELDER (Doe) [5]
NEWUOA	**1.1**	**1.5**	3.5	**2.6**	**2.5**	**2.5**	**2.6**	**1.1**	**1.1**	**1.1**	NEWUOA [31]
(1+1)-ES	**2.6**	1162	21289	60585	1.90e5	*23e-1/1e6*	.	.	.	.	(1+1)-ES [1]
POEMS	175	210	1900	2912	8859	*17e-1/1e5*	.	.	.	.	POEMS [20]
PSO	28	35	747	3750	5412	7886	15188	*41e-1/1e5*	.	.	PSO [7]
PSO_Bounds	125	181	1866	2457	5493	17093	*46e-1/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	*19e+3/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.4**	**1.4**	98	63	91	103	95	46	42	48	Rosenbrock [27]
VNS (Garcia)	6.9	9.0	19	12	10	10	9.4	4.0	3.8	3.6	VNS (Garcia) [11]

Table 61: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{13} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.56	8.9	26	39	50	64	262	305	350	451	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**2.7**	43	50	83	281	441	566	2329	3900	*76e-7/1e6*	ALPS-GA [17]
AMaLGaM IDEA	3.3	5.8	4.2	4.6	**4.9**	**4.9**	**1.5**	**1.5**	**1.4**	**1.4**	AMaLGaM IDEA [4]
BayEDAcG	**1.9**	38	174	354	*19e+0/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.4	3.8	3.9	5.4	5.9	5.4	**1.6**	**1.6**	**1.5**	**1.7**	BIPOP-CMA-ES [15]
BFGS	4.6	**1.2**	**1**	**1**	**1**	**1**	4.8	24	136	*37e-6/1e4*	BFGS [30]
Cauchy EDA	54	31	21	24	25	25	7.4	7.5	7.3	7.3	Cauchy EDA [24]
(1+1)-CMA-ES	**2.6**	**2.1**	4.4	6.3	6.1	6.3	**1.9**	**2.9**	3.2	3.1	(1+1)-CMA-ES [2]
DASA	54	51	200	644	2454	7815	5037	13912	*23e-4/1e6*	.	DASA [19]
DEPSO	**2.1**	8.7	11	349	276	236	*21e-1/2e3*	.	.	.	DEPSO [12]
DIRECT	**1.6**	4.7	7.0	21	34	144	42	57	119	*12e-6/2e4*	DIRECT [25]
EDA-PSO	3.4	47	149	390	1986	10405	*64e-3/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	5.5	**1**	**1.8**	6.7	23	85	97	*19e-4/1e4*	.	.	full NEWUOA [31]
G3-PCX	3.3	3.9	14	60	152	341	124	263	592	*15e-5/5e4*	G3-PCX [26]
simple GA	**2.6**	123	242	728	4394	22486	*20e-2/1e5*	.	.	.	simple GA [22]
GLOBAL	3.4	7.4	4.2	6.1	11	*19e-2/300*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.9**	3.1	**2.6**	**3.0**	**3.2**	**3.3**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.1	**2.9**	9.0	11	12	11	**2.8**	**2.7**	**2.5**	**2.3**	IPOP-SEP-CMA-ES [29]
LSfminbnd	14	15	33	149	544	1094	*19e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	249	135	546	1122	2873	*22e+0/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.8**	10	8.3	21	24	19	5.1	4.8	5.3	4.9	MA-LS-Chain [21]
MCS	**1**	**1.6**	41	214	462	2256	550	*21e-2/1e4*	.	.	MCS [18]
NELDER (Han)	**2.2**	**1.2**	**2.0**	3.8	5.3	4.9	**1.3**	**1.3**	**1.2**	**1.3**	NELDER (Han) [16]
NELDER (Doe)	**2.9**	**1.7**	**2.4**	**2.4**	5.3	6.1	**1.9**	**2.5**	3.9	5.0	NELDER (Doe) [5]
NEWUOA	**2.6**	**1.8**	3.1	9.3	35	55	54	120	335	*17e-4/8e3*	NEWUOA [31]
(1+1)-ES	4.3	11	20	30	110	246	156	352	1518	7249	(1+1)-ES [1]
POEMS	312	57	87	659	5647	10310	*22e-2/1e5*	.	.	.	POEMS [20]
PSO	3.0	8.7	1579	10294	28046	*57e-1/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	**1.3**	20	348	2376	5658	10363	5433	*81e-2/1e5*	.	.	PSO_Bounds [8]
Monte Carlo	**1.9**	960	*30e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	8.6	3.1	7.6	13	26	49	39	56	63	290	Rosenbrock [27]
VNS (Garcia)	**1.9**	6.2	4.8	5.6	6.6	6.2	**1.9**	**1.9**	**1.9**	**2.1**	VNS (Garcia) [11]

Table 62: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{14} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.20	0.20	2.0	8.2	12	18	28	42	50	95	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.3**	**2.5**	32	66	72	75	125	395	10067	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.5**	**2.1**	4.5	6.1	6.6	5.8	5.0	5.2	3.8	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.4**	**3.0**	105	223	250	1039	*12e-2/2e3*	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.3**	**1.1**	**2.8**	3.7	4.0	4.6	4.3	5.4	4.5	BIPOP-CMA-ES [15]
BFGS	**1**	3.4	**2.2**	**1.7**	**1.8**	**1.5**	**1.3**	**1**	**1**	350	BFGS [30]
Cauchy EDA	**1**	18	23	29	40	40	33	28	28	19	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**2.2**	**1.8**	**1.9**	**2.3**	**2.3**	**2.6**	3.3	4.0	3.2	(1+1)-CMA-ES [2]
DASA	**1**	18	19	18	20	21	49	462	3477	*12e-7/1e6*	DASA [19]
DEPSO	**1**	**1.5**	**2.6**	6.9	8.9	11	17	45	*47e-6/2e3*	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	3.7	4.8	7.4	23	373	1892	*62e-6/2e4*	DIRECT [25]
EDA-PSO	**1**	**1.5**	**1.4**	7.1	96	192	211	186	295	*22e-7/1e5*	EDA-PSO [6]
full NEWUOA	**1**	**2.8**	**2.7**	**1.1**	**1.1**	**1**	**1**	**1.4**	3.2	26	full NEWUOA [31]
G3-PCX	**1**	**1.1**	**1.7**	3.5	3.5	3.6	5.0	10	26	388	G3-PCX [26]
simple GA	**1**	**1.8**	**2.1**	91	267	306	350	3289	*13e-5/1e5*	.	simple GA [22]
GLOBAL	**1.1**	**1.7**	**2.2**	7.7	5.9	4.4	3.3	**2.6**	3.6	*59e-7/300*	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.3**	**1.4**	**2.7**	4.3	4.5	4.1	3.5	3.6	**2.7**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.5**	**1.6**	3.0	3.6	3.6	5.3	9.0	10	6.4	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	3.7	5.9	4.5	4.3	7.4	70	1702	*35e-5/1e4*	.	LSfminbnd [28]
LSstep	**1**	28	117	96	97	180	*35e-4/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.3**	**2.0**	7.2	11	11	11	13	16	12	MA-LS-Chain [21]
MCS	**1**	**1**	**1.4**	**2.8**	**2.7**	**2.5**	**2.8**	3.4	225	*10e-6/1e4*	MCS [18]
NELDER (Han)	**1**	**1.3**	**1.1**	**1.2**	**1.5**	**1.5**	**1.4**	**1.2**	**1.3**	**1**	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.3**	**1.1**	**1.1**	**1.4**	**1.6**	**1.7**	**1.6**	**1.6**	**1.3**	NELDER (Doe) [5]
NEWUOA	**1**	**1.8**	**1.7**	**1**	**1**	**1.0**	**1.2**	**1.9**	5.5	2525	NEWUOA [31]
(1+1)-ES	**1**	3.0	**2.1**	**1.8**	**2.1**	**2.2**	5.6	66	1119	*12e-7/1e6*	(1+1)-ES [1]
POEMS	**1**	182	108	42	81	131	138	130	631	*31e-7/1e5*	POEMS [20]
PSO	**1**	**1.4**	**1.9**	5.6	15	21	30	50	218	*90e-8/1e5*	PSO [7]
PSO_Bounds	**1**	**1.7**	**1.9**	12	45	74	139	203	408	*14e-7/1e5*	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	**1.2**	100	75612	*93e-3/1e6*	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	7.9	**2.4**	**1.2**	**1.3**	**1.5**	4.6	23	26	43	Rosenbrock [27]
VNS (Garcia)	**1**	**1.2**	3.3	5.5	5.4	5.3	5.3	5.4	7.0	5.5	VNS (Garcia) [11]

Table 63: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_{15} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.20	2.6	102	1862	3874	3949	4015	4084	4154	4272	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1.1**	**1.9**	9.2	9.0	26	26	26	25	25	25	ALPS-GA [17]
AMaLGaM IDEA	**1.3**	**2.7**	**1.7**	**2.6**	**5.3**	**5.2**	**5.2**	**5.1**	**5.1**	**5.0**	AMaLGaM IDEA [4]
BayEDAcG	**1.2**	**2.7**	4.8	*61e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.3**	**1.6**	**1.5**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
BFGS	**2.2**	46	87	*13e+0/3e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	8.7	36	12	186	*24e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1.4**	**2.0**	10	80	*30e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	15	26	231	1734	*20e-1/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	5.7	7.9	*41e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1.2**	5.4	9.4	*99e-2/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.1**	**2.0**	20	7.5	24	23	23	24	24	24	EDA-PSO [6]
full NEWUOA	**1.9**	**2.9**	6.3	55	*50e-1/7e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.3**	**2.2**	126	373	*50e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	**1.9**	35	91	367	361	355	350	345	*15e-1/1e5*	simple GA [22]
GLOBAL	**1**	**2.0**	6.0	*90e-1/500*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.8**	**1**	7.0	9.2	9.1	9.0	8.9	8.8	8.6	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.5**	**1.7**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	4.0	35	*60e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1.1**	80	1381	80	*24e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	**2.3**	**2.6**	5.3	6.0	5.9	5.8	5.7	5.6	5.5	MA-LS-Chain [21]
MCS	**1**	**1**	4.0	25	38	38	37	36	36	*20e-1/1e4*	MCS [18]
NELDER (Han)	**1.7**	**2.5**	20	43	83	81	80	79	77	75	NELDER (Han) [16]
NELDER (Doe)	**1.3**	5.0	4.5	20	73	72	71	70	69	67	NELDER (Doe) [5]
NEWUOA	**1.9**	7.8	5.8	41	*30e-1/5e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1.3**	**1.7**	28	103	246	241	237	233	229	223	(1+1)-ES [1]
POEMS	**1**	80	15	130	375	368	362	356	350	341	POEMS [20]
PSO	**1.1**	**1.5**	16	221	366	359	353	348	342	333	PSO [7]
PSO_Bounds	**1.3**	**2.3**	171	119	*20e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1.2**	**1.7**	6857	*83e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	4.4	191	311	*16e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	3.1	**2.4**	5.9	684	689	684	689	678	667	VNS (Garcia) [11]

Table 64: Running time excess ERT/ERT$_{\text{best}}$ on f_{16} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.20	0.24	24	122	532	2033	2090	2283	2329	2419	ERT$_{\text{best}}$/D
ALPS-GA	**1**	**1.7**	**2.5**	8.6	6.3	6.7	13	60	157	826	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.4**	3.0	15	12	5.0	4.9	**5.6**	**5.5**	**5.4**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.2**	5.7	*35e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.1**	3.0	**3.6**	**2.6**	**1.1**	**1.3**	**1.3**	**1.4**	**1.4**	BIPOP-CMA-ES [15]
BFGS	**1**	4.2	153	960	*49e-1/8e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	3.4	5.6	1193	*15e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	**2.5**	10	17	21	31	62	60	*70e-3/1e4*	(1+1)-CMA-ES [2]
DASA	**1**	6.6	4.8	308	975	1236	*24e-3/1e6*	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	11	*42e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**2.0**	**1.2**	**1.6**	**3.4**	**2.1**	5.9	10	19	40	DIRECT [25]
EDA-PSO	**1**	**1.4**	4.6	206	82	38	53	49	61	61	EDA-PSO [6]
full NEWUOA	**1**	**2.3**	**2.7**	12	29	32	*12e-2/1e4*	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.2**	**1**	22	44	32	347	318	*60e-4/5e4*	.	G3-PCX [26]
simple GA	**1**	**1.3**	**2.1**	84	93	71	148	631	621	605	simple GA [22]
GLOBAL	**1**	**1.3**	**1.4**	**1**	**1**	**1.3**	**3.5**	7.0	6.8	6.6	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.4**	**1.9**	8.6	5.5	4.4	5.9	6.5	6.4	6.8	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.1**	**2.1**	5.0	3.5	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.3**	3.2	28	133	71	*37e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	**1**	**1.1**	14	276	*13e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	**2.7**	8.2	18	11	26	51	50	75	MA-LS-Chain [21]
MCS	**1**	**1.8**	**1.9**	18	131	*30e-2/1e4*	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1.5**	4.4	28	23	25	95	202	302	597	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.3**	**1.6**	4.8	10	6.3	13	27	59	119	NELDER (Doe) [5]
NEWUOA	**1**	**1.2**	**2.1**	29	*50e-2/7e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.1**	37	88	344	591	2156	6217	*73e-4/1e6*	.	(1+1)-ES [1]
POEMS	**1**	134	12	74	76	58	57	53	52	54	POEMS [20]
PSO	**1**	**1.2**	**2.4**	6.2	59	55	89	306	300	580	PSO [7]
PSO_Bounds	**1**	**1.2**	**2.4**	36	140	140	317	622	*16e-3/1e5*	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	3.5	510	*30e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1.8**	40	1191	*36e-1/1e4*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.2**	**2.8**	12	12	9.1	12	16	34	45	VNS (Garcia) [11]

Table 65: Running time excess ERT/ERT$_{\text{best}}$ on f_{17} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.20	0.20	1.0	43	180	572	734	959	1270	1587	ERT$_{\text{best}}$/D
ALPS-GA	**1**	**1.1**	**2.4**	12	8.0	4.8	7.1	10	21	68	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	3.9	**1.5**	**2.7**	**2.6**	**2.7**	**3.5**	**3.4**	**3.5**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.3**	**2.2**	6.7	5.4	4.1	7.5	15	*47e-4/2e3*	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.3**	3.4	**1**	**1**	**1**	**1**	**1**	**1**	**1.2**	BIPOP-CMA-ES [15]
BFGS	**1**	3.4	120	645	*19e-1/4e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	44	13	7.0	3.8	4.3	4.3	5.3	13	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.1**	4.5	27	108	*17e-2/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	25	169	384	730	1844	19194	*82e-4/1e6*	.	.	DASA [19]
DEPSO	**1**	**1**	7.6	3.5	**2.8**	3.1	4.5	5.6	12	*31e-4/2e3*	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1.4**	**1.7**	**2.7**	4.4	6.7	9.5	10	DIRECT [25]
EDA-PSO	**1**	**1.1**	**2.4**	27	28	16	18	18	17	19	EDA-PSO [6]
full NEWUOA	**1**	**1.1**	4.9	25	76	253	*13e-2/1e4*	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	**2.2**	129	292	*60e-3/5e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.3**	5.4	46	36	52	189	324	550	*13e-4/1e5*	simple GA [22]
GLOBAL	**1**	**1.3**	3.5	5.0	*47e-2/600*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**2.7**	**1.1**	3.8	**2.9**	4.6	5.0	6.3	6.8	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.1**	3.8	3.4	**1.3**	**1.0**	**1.0**	**1.1**	**1.1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.3**	238	64	175	256	*16e-2/1e4*	.	.	.	LSfminbnd [28]
LSstep	**1**	**1.1**	151	676	*26e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.2**	3.8	**2.8**	3.1	4.1	9.3	7.5	7.3	11	MA-LS-Chain [21]
MCS	**1**	**1**	**1.9**	24	63	*87e-3/1e4*	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**2.0**	55	170	295	2482	*54e-3/1e5*	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**1.9**	10	48	*36e-3/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.2**	**2.3**	40	617	*32e-2/7e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**2.0**	1196	7940	37609	*48e-2/1e6*	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	138	167	15	14	21	19	17	29	41	POEMS [20]
PSO	**1**	**1.1**	3.3	169	142	156	548	420	514	420	PSO [7]
PSO_Bounds	**1**	**1.1**	3.4	7.9	52	35	51	49	61	122	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	4.0	838	*48e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	2695	*57e-1/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	6.6	**1.6**	4.8	4.8	7.9	10	18	82	VNS (Garcia) [11]

Table 66: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{18} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.20	0.24	21	76	794	1690	1856	2076	2181	2494	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.5**	8.1	14	3.3	14	49	240	421	*53e-7/1e6*	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	**2.1**	**1.6**	**1.7**	**2.0**	**1.5**	**2.4**	3.1	3.4	**3.1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**2.6**	4.4	10	11	8.7	*14e-2/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.8**	**1**	3.4	**1**	**1**	**1**	**1.1**	**1.2**	**1.3**	BIPOP-CMA-ES [15]
BFGS	**1.8**	104	57	*51e-1/4e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**2.5**	83	13	12	**2.4**	**2.1**	**2.7**	**2.8**	3.7	8.6	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**2.9**	4.9	57	84	*37e-2/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1.9**	47	274	934	1633	*64e-3/1e6*	.	.	.	.	DASA [19]
DEPSO	**1.1**	**2.4**	**2.6**	5.5	**2.2**	4.1	*57e-3/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.4**	**2.9**	**1.9**	6.2	6.5	8.1	*44e-6/2e4*	.	DIRECT [25]
EDA-PSO	**1**	**1.3**	3.6	41	8.8	6.4	17	34	41	58	EDA-PSO [6]
full NEWUOA	**1**	8.6	10	84	90	88	*78e-2/1e4*	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.7**	135	801	*12e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	**2.3**	22	59	34	134	*15e-3/1e5*	.	.	.	simple GA [22]
GLOBAL	**1.1**	**2.4**	3.9	15	14	*12e-1/500*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	**2.0**	**1.1**	**1**	**1.4**	**1.6**	**1.9**	**2.3**	**3.1**	4.8	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	3.0	**1.3**	5.0	**1.6**	**1.0**	**1.0**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	3.2	64	71	*31e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1.1**	158	148	396	86	*60e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.8**	**2.5**	4.9	**1.3**	23	88	84	162	143	MA-LS-Chain [21]
MCS	**1**	**1.5**	19	154	*75e-2/1e4*	.	.	.	.	.	MCS [18]
NELDER (Han)	**1.1**	**2.9**	45	228	321	*17e-2/1e5*	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.2**	4.3	28	43	*15e-2/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1.2**	5.7	31	1351	*11e-1/2e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.9**	3078	30673	*22e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	41	556	18	24	14	71	153	198	304	568	POEMS [20]
PSO	**1**	**2.6**	**2.2**	6.6	113	253	*53e-3/1e5*	.	.	.	PSO [7]
PSO_Bounds	**1.1**	**2.5**	3.8	21	69	72	118	334	*10e-3/1e5*	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.2**	18	94073	*15e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.1**	2611	3376	*16e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.5**	**2.2**	4.9	3.6	8.6	26	46	296	1186	VNS (Garcia) [11]

Table 67: Running time excess ERT/ERT_{best} on f_{19} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.20	0.20	0.20	0.20	48	20972	24088	24169	24229	24404	ERT_{best}/D
ALPS-GA	**1**	**1.1**	58	5112	502	15	39	40	40	40	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.3**	38	1148	364	4.5	4.2	**4.2**	**4.2**	**4.2**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	37	2088	*45e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	20	2801	161	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	**2.2**	1655	21914	1780	*62e-2/6e3*	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	9.4	296	20720	*48e-2/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	20	4113	971	*19e-2/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	4.8	288	67234	46915	*13e-2/1e6*	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	93	3140	*71e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**1.1**	**4.2**	**3.7**	*16e-3/2e4*	.	.	DIRECT [25]
EDA-PSO	**1**	**1.2**	37	6712	1635	71	*66e-3/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**2.7**	31	10526	865	6.9	*19e-2/1e4*	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	39	95055	14455	*50e-2/5e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.1**	35	11789	699	68	60	*59e-3/1e5*	.	.	simple GA [22]
GLOBAL	**1**	**1.3**	46	7329	*10e-1/900*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	28	1117	373	10	12	12	12	12	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.1**	22	1931	162	**2.2**	**3.0**	**3.0**	**3.0**	**3.0**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	5.9	54	2950	*38e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	29	914	9487	1463	*23e-2/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.2**	32	1274	249	8.4	*47e-3/2e4*	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	*16e-3/1e4*	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1.3**	12	2885	590	*59e-3/1e5*	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.2**	**12**	**340**	**107**	14	*47e-3/2e4*	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.9**	14	26728	1415	*79e-3/1e5*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.3**	104	4.12e5	2.91e5	*49e-2/1e6*	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	202	1019	7180	13782	*18e-2/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1.1**	35	3381	2448	67	60	60	61	61	PSO [7]
PSO_Bounds	**1**	**1.4**	27	16150	2508	70	*80e-3/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	38	1.40e5	*36e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.2	13075	7.13e5	*38e-1/1e4*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	55	7619	1309	20	75	81	134	261	VNS (Garcia) [11]

Table 68: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{20} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.7	3.0	3.2	170	7622	10272	10894	10921	10972	11063	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	5.3	15	18	7.0	**1.3**	**1**	**1.0**	**1.1**	**1.1**	**1.3**	ALPS-GA [17]
AMaLGaM IDEA	3.2	3.8	3.9	29	24	18	17	17	17	17	AMaLGaM IDEA [4]
BayEDAcG	**2.5**	4.0	8.0	*20e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.2**	**2.9**	3.3	8.2	**2.8**	**2.2**	**2.1**	**2.2**	**2.2**	**2.2**	BIPOP-CMA-ES [15]
BFGS	**1.1**	**1.5**	**1.8**	**2.5**	10	7.6	7.2	7.2	7.1	7.1	BFGS [30]
Cauchy EDA	44	49	48	464	*11e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1.5**	**2.1**	**2.4**	6.4	5.9	4.4	4.1	4.1	4.1	4.1	(1+1)-CMA-ES [2]
DASA	24	29	32	13	47	35	33	33	33	33	DASA [19]
DEPSO	3.6	7.7	8.6	3.2	*24e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	4.5	4.1	3.8	**1.5**	*47e-2/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	3.3	4.9	5.7	13	**2.5**	**2.0**	**2.0**	**2.1**	**2.3**	**2.5**	EDA-PSO [6]
full NEWUOA	**1.6**	**1.5**	**1.4**	6.4	*47e-2/6e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	3.2	7.7	7.4	36	88	66	62	62	61	61	G3-PCX [26]
simple GA	5.5	22	47	21	**1**	**1.0**	**1.3**	**2.2**	**2.6**	5.0	simple GA [22]
GLOBAL	4.8	12	17	18	*13e-1/500*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**2.1**	3.0	3.2	30	25	19	18	18	18	18	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.1**	3.0	3.3	6.6	**2.3**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	IPOP-SEP-CMA-ES [29]
LSfminbnd	5.8	7.0	8.2	18	*65e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	111	186	232	41	18	14	13	13	13	13	LSstep [28]
MA-LS-Chain	**2.9**	5.6	5.8	4.1	**1.4**	**1.1**	**1**	**1**	**1**	**1**	MA-LS-Chain [21]
MCS	**2.5**	**2.8**	**2.7**	**1**	9.1	6.8	6.4	6.4	6.4	6.3	MCS [18]
NELDER (Han)	**1.1**	**1.5**	**1.5**	25	*24e-2/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.8**	**2.1**	**2.2**	8.5	37	28	26	26	26	26	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	3.3	*43e-2/6e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	3.4	3.9	4.0	16	43	32	30	30	30	30	(1+1)-ES [1]
POEMS	83	80	78	8.5	14	10	10	10	10	10	POEMS [20]
PSO	**2.5**	6.0	8.7	3.1	27	20	19	19	19	18	PSO [7]
PSO_Bounds	3.1	7.0	8.1	8.6	21	16	15	15	15	16	PSO_Bounds [8]
Monte Carlo	6.7	20	29	9234	*99e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.6**	**2.8**	**2.9**	4.6	*47e-2/1e4*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	3.7	11	10	7.8	4.3	3.9	4.3	4.5	4.6	5.7	VNS (Garcia) [11]

Table 69: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{21} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.20	0.20	8.2	231	335	338	341	344	346	351	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	3.4	**2.2**	**2.9**	3.9	4.7	5.6	6.4	8.1	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	3.0	37	34	35	36	38	38	38	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	4.1	8.6	40	85	84	84	83	82	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**2.3**	14	24	25	25	25	25	25	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	3.8	**1.4**	**1.9**	**1.9**	**1.9**	**1.9**	**1.9**	**2.0**	BFGS [30]
Cauchy EDA	**1**	**1**	20	27	192	428	424	422	419	413	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	4.2	4.6	6.6	6.6	6.5	6.5	6.5	6.4	(1+1)-CMA-ES [2]
DASA	**1**	**1**	10	214	321	318	316	314	312	308	DASA [19]
DEPSO	**1**	**1**	4.2	5.5	4.2	4.7	5.0	5.3	6.2	6.7	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**1.1**	**1.8**	**2.1**	**2.9**	19	19	DIRECT [25]
EDA-PSO	**1**	**1**	4.0	161	113	114	116	118	120	124	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.4**	**2.3**	**2.8**	**2.8**	**2.8**	**2.7**	**2.7**	**2.7**	full NEWUOA [31]
G3-PCX	**1**	**1**	**2.1**	4.7	6.8	6.7	6.7	6.7	6.7	6.6	G3-PCX [26]
simple GA	**1**	**1**	4.6	5.5	61	68	70	77	139	291	simple GA [22]
GLOBAL	**1**	**1**	**2.3**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**2.2**	27	22	22	22	22	22	22	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	3.6	14	10	10	10	10	10	10	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	30	38	39	45	44	44	44	44	LSfminbnd [28]
LSstep	**1**	**1**	564	122	123	124	125	128	130	134	LSstep [28]
MA-LS-Chain	**1**	**1**	3.6	22	16	16	16	16	16	16	MA-LS-Chain [21]
MCS	**1**	**1**	**1.0**	3.9	5.1	5.1	5.0	5.0	5.0	5.0	MCS [18]
NELDER (Han)	**1**	**1**	12	8.4	10	10	10	10	10	10	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.9**	**1.5**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.1**	**2.2**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.9**	NEWUOA [31]
(1+1)-ES	**1**	**1**	45	19	18	18	18	18	18	18	(1+1)-ES [1]
POEMS	**1**	**1**	34	325	290	288	288	287	286	285	POEMS [20]
PSO	**1**	**1**	**2.0**	379	262	260	258	256	255	252	PSO [7]
PSO_Bounds	**1**	**1**	3.5	380	343	341	339	338	338	335	PSO_Bounds [8]
Monte Carlo	**1**	**1**	3.2	8.5	272	13530	*14e-3/1e6*	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	10	7.9	15	15	15	15	15	15	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.4**	7.5	6.5	6.6	6.9	7.8	8.3	9.1	VNS (Garcia) [11]

Table 70: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_{22} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.20	0.20	14	77	188	196	202	205	208	214	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	**1**	6.6	9.3	8.8	13	17	21	24	34	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**3.0**	19	59	69	69	69	68	67	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	13	75	*22e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	6.9	20	45	43	42	42	41	40	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	3.1	**2.9**	**2.1**	**2.1**	**2.0**	**2.0**	**2.0**	**2.6**	BFGS [30]
Cauchy EDA	**1**	**1**	11	281	775	1662	3474	3412	3367	3282	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	**2.8**	7.1	4.7	4.6	4.5	4.5	4.4	4.4	(1+1)-CMA-ES [2]
DASA	**1**	**1**	96	268	129	128	130	135	140	152	DASA [19]
DEPSO	**1**	**1**	6.5	6.3	7.5	10	11	14	16	32	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	12	19	22	62	128	400	DIRECT [25]
EDA-PSO	**1**	**1**	6.7	12	89	90	92	95	98	104	EDA-PSO [6]
full NEWUOA	**1**	**1**	4.3	3.7	3.0	**2.9**	**2.9**	**3.0**	**3.0**	3.1	full NEWUOA [31]
G3-PCX	**1**	**1**	12	15	13	12	12	12	12	12	G3-PCX [26]
simple GA	**1**	**1**	6.0	18	388	648	1489	6913	6830	*24e-3/1e5*	simple GA [22]
GLOBAL	**1**	**1**	3.6	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.8**	22	40	41	41	41	41	40	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	7.5	23	60	58	57	57	56	55	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	13	47	29	60	62	115	122	220	LSfminbnd [28]
LSstep	**1**	**1**	191	177	380	*11e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	3.3	15	22	22	22	22	22	22	MA-LS-Chain [21]
MCS	**1**	**1**	**1.0**	**1.1**	12	11	11	11	11	15	MCS [18]
NELDER (Han)	**1**	**1**	19	13	13	13	13	12	12	12	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**2.5**	**2.5**	**2.1**	**2.0**	**2.0**	**2.0**	**2.0**	**2.1**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.1**	**2.1**	**2.0**	**2.0**	**2.1**	**2.2**	**2.3**	**2.4**	NEWUOA [31]
(1+1)-ES	**1**	**1**	21	37	30	29	29	29	29	30	(1+1)-ES [1]
POEMS	**1**	**1**	468	1058	1302	1248	1216	1196	1183	1157	POEMS [20]
PSO	**1**	**1**	**2.6**	325	469	450	439	433	429	422	PSO [7]
PSO_Bounds	**1**	**1**	506	868	820	816	813	819	817	815	PSO_Bounds [8]
Monte Carlo	**1**	**1**	7.6	73	394	7512	71348	70067	*93e-4/1e6*	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	19	13	10	10	10	10	10	11	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	5.8	16	18	18	18	18	19	20	VNS (Garcia) [11]

Table 71: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.20	0.20	0.60	104	2850	5578	6331	6479	6606	6851	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS-GA	**1**	**1**	**2.2**	21	29	102	3101	*54e-4/1e6*	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.7**	7.0	**1.8**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.8**	62	*12e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.7**	13	3.7	**2.1**	**1.8**	**1.8**	**1.8**	**1.8**	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	11	31	*69e-2/5e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	**2.2**	234	*68e-2/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	4.2	3.3	7.5	26	*11e-2/1e4*	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	9.0	20	362	*88e-3/1e6*	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	**2.0**	66	*15e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.5**	3.5	5.7	3.7	6.0	*93e-4/2e4*	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	**2.4**	28	*59e-2/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	5.4	**2.0**	3.8	*87e-3/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1**	**2.6**	**2.4**	8.6	60	*44e-3/5e4*	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	**1.5**	59	*49e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**1.6**	**1.0**	4.8	*23e-2/1e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**2.6**	7.8	**2.1**	**1.3**	**1.2**	**1.2**	**1.1**	**1.1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	3.1	10	3.7	**1.9**	**1.7**	**1.7**	**1.7**	**1.6**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	**1.8**	11	*45e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	**1.4**	6.6	51	*31e-2/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**2.6**	**2.5**	**1.7**	4.0	3.6	3.5	3.4	3.3	MA-LS-Chain [21]
MCS	**1**	**1**	3.4	**2.4**	51	*16e-2/1e4*	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1**	**2.9**	3.5	**2.7**	3.2	4.0	4.6	4.6	5.6	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.5**	**1**	**1**	3.6	15	46	*38e-4/2e4*	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	6.2	**2.4**	7.1	*20e-2/7e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	3.1	4.8	52	594	*14e-3/1e6*	.	.	.	(1+1)-ES [1]
POEMS	**1**	**1**	13	23	26	22	25	33	33	32	POEMS [20]
PSO	**1**	**1**	**2.2**	20	243	*15e-2/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1**	**2.1**	58	242	*30e-2/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.3**	49	*38e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**1.6**	**1.8**	4.6	13	*17e-2/5e3*	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**1**	10	15	26	23	26	25	24	VNS (Garcia) [11]

Table 72: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{24} in **5-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.20	0.20	324	43284	1.27e6	1.92e6	1.92e6	1.92e6	2.57e6	2.57e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	5.0	8.1	10	*75e-2/1e6*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	5.3	3.3	**2.4**	**2.1**	**3.8**	**3.7**	**3.7**	**5.6**	**5.6**	AMaLGaM IDEA [4]
BayEDAcG	**1**	5.4	15	*11e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	7.8	**2.1**	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	157	69	*17e+0/3e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.1**	75	30	*81e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	76	6.7	**1.7**	*39e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	79	253	*32e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	5.0	29	*14e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	7.5	**1.9**	*72e-1/2e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	3.6	10	*61e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	21	**2.5**	**1.1**	*31e-1/7e3*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	4.9	44	*61e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	7.3	21	*54e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	6.3	4.2	*91e-1/1e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	6.3	3.1	**2.2**	**2.2**	**7.5**	**7.5**	**7.5**	**5.6**	**5.6**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	7.5	**1.8**	**1**	*53e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	30	9.1	*63e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	3.0	362	203	*15e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	3.8	**2.1**	*52e-1/2e4*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	7.0	3.5	*37e-1/1e4*	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	10	11	5.6	*12e-1/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	4.3	**1**	**1.4**	*15e-1/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	12	**2.9**	**2.1**	*26e-1/6e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	14	31	68	*14e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	624	47	*70e-1/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	**1**	6.5	5.7	*63e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	5.2	10	33	*60e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	4.1	2948	*96e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	196	212	*19e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**3.4**	3.3	49	13	16	46	202	*69e-4/3e7*	.	VNS (Garcia) [11]

Table 73: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_1 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.10	0.10	2.2	2.3	2.3	2.3	2.3	2.3	2.3	2.3	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	8.9	84	232	414	587	776	953	1147	1549	ALPS-GA [17]
AMaLGaM IDEA	**1**	5.0	18	45	73	100	130	161	188	237	AMaLGaM IDEA [4]
BayEDAcG	**1**	6.5	39	105	234	300	368	438	504	641	BayEDAcG [10]
BIPOP-CMA-ES	**1**	7.8	5.7	12	18	25	31	38	44	58	BIPOP-CMA-ES [15]
BFGS	**1**	13	**1.0**	**1.0**	**1.0**	**1**	**1**	**1**	**1**	**1**	BFGS [30]
Cauchy EDA	**1**	237	165	348	512	696	875	1056	1234	1608	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	5.3	3.8	7.5	11	15	18	22	25	33	(1+1)-CMA-ES [2]
DASA	**1**	111	29	45	59	77	95	113	130	181	DASA [19]
DEPSO	**1**	**3.2**	19	45	84	128	171	223	283	391	DEPSO [12]
DIRECT	**1**	**1**	8.8	31	64	97	136	191	243	399	DIRECT [25]
EDA-PSO	**1**	9.2	22	799	1542	2347	3148	3947	4718	6374	EDA-PSO [6]
full NEWUOA	**1**	40	3.1	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	full NEWUOA [31]
G3-PCX	**1**	4.7	7.9	11	15	20	24	28	33	43	G3-PCX [26]
simple GA	**1**	4.4	309	1173	2122	3224	4446	7063	12043	60620	simple GA [22]
GLOBAL	**1**	5.3	15	14	14	14	14	14	14	14	GLOBAL [23]
iAMaLGaM IDEA	**1**	5.7	8.5	25	41	57	72	87	104	137	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	5.3	4.8	11	16	21	26	33	37	48	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	39	7.1	8.1	8.3	8.3	8.3	8.3	8.3	8.3	LSfminbnd [28]
LSstep	**1**	962	138	153	158	157	157	157	157	157	LSstep [28]
MA-LS-Chain	**1**	4.7	12	36	58	80	108	125	144	178	MA-LS-Chain [21]
MCS	**1**	**1**	**1.2**	**2.0**	**2.1**	**2.2**	**2.9**	**2.9**	**2.9**	**2.9**	MCS [18]
NELDER (Han)	**1**	7.1	**2.5**	6.1	9.5	13	16	19	23	31	NELDER (Han) [16]
NELDER (Doe)	**1**	8.3	**2.4**	5.3	8.1	11	14	17	21	32	NELDER (Doe) [5]
NEWUOA	**1**	14	**1**	**1**	**1**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	NEWUOA [31]
(1+1)-ES	**1**	17	3.9	6.9	10	13	16	19	22	28	(1+1)-ES [1]
POEMS	**1**	1623	135	223	623	1034	1501	1963	2418	3304	POEMS [20]
PSO	**1**	5.8	10	55	101	151	214	276	333	454	PSO [7]
PSO_Bounds	**1**	5.7	18	182	705	1382	1715	2080	2478	5258	PSO_Bounds [8]
Monte Carlo	**1**	5.4	3014	*35e-1 /1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	37	3.4	4.9	6.5	8.1	10	11	13	16	Rosenbrock [27]
VNS (Garcia)	**1**	12	12	18	26	32	38	44	51	65	VNS (Garcia) [11]

Table 74: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_2 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	15	18	19	19	19	19	19	19	19	20	$\mathrm{ERT_{best}}$/D
ALPS-GA	47	58	80	102	125	150	173	197	223	279	ALPS-GA [17]
AMaLGaM IDEA	8.7	11	15	20	25	29	32	35	39	46	AMaLGaM IDEA [4]
BayEDAcG	32	34	42	57	66	74	81	89	97	112	BayEDAcG [10]
BIPOP-CMA-ES	11	14	20	24	26	27	28	28	29	30	BIPOP-CMA-ES [15]
BFGS	4.7	7.5	10	12	14	14	14	14	15	15	BFGS [30]
Cauchy EDA	60	72	95	117	140	164	187	210	231	272	Cauchy EDA [24]
(1+1)-CMA-ES	7.9	10	16	20	21	22	23	23	24	25	(1+1)-CMA-ES [2]
DASA	6.4	6.7	8.6	11	13	15	18	21	25	34	DASA [19]
DEPSO	8.9	11	16	22	28	34	42	48	55	69	DEPSO [12]
DIRECT	11	12	15	149	153	157	166	382	413	1018	DIRECT [25]
EDA-PSO	199	250	350	436	524	617	706	805	889	1074	EDA-PSO [6]
full NEWUOA	6.2	18	53	150	304	586	2517	7731	*53e-4/1e4*	.	full NEWUOA [31]
G3-PCX	13	31	89	187	291	368	462	542	644	861	G3-PCX [26]
simple GA	239	303	824	1394	2661	4421	7032	11745	73632	*53e-4/1e5*	simple GA [22]
GLOBAL	6.5	8.6	12	13	14	14	15	15	15	16	GLOBAL [23]
iAMaLGaM IDEA	5.9	7.9	11	14	16	18	19	21	23	27	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.9	5.6	6.9	7.7	8.5	9.3	**10**	**11**	11	**12**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	19	16	16	16	16	16	16	16	16	16	LSstep [28]
MA-LS-Chain	7.0	10	14	18	23	27	32	37	42	52	MA-LS-Chain [21]
MCS	**1**	**1.3**	**3.2**	**4.6**	**6.5**	**7.5**	10	11	**11**	107	MCS [18]
NELDER (Han)	3.9	5.1	**6.1**	**7.0**	**8.1**	**8.6**	**9.2**	**10**	**10**	**11**	NELDER (Han) [16]
NELDER (Doe)	4.2	10	22	52	83	102	119	126	128	203	NELDER (Doe) [5]
NEWUOA	**1.2**	4.4	13	37	74	104	148	183	219	301	NEWUOA [31]
(1+1)-ES	280	1253	5556	13519	23378	31484	48543	1.39e5	2.42e5	7.55e5	(1+1)-ES [1]
POEMS	133	177	222	278	325	383	429	467	544	645	POEMS [20]
PSO	17	26	41	417	423	427	433	438	444	454	PSO [7]
PSO_Bounds	120	186	291	423	530	598	893	1213	1482	1767	PSO_Bounds [8]
Monte Carlo	*67e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.6**	**3.4**	39	101	160	210	221	276	371	650	Rosenbrock [27]
VNS (Garcia)	20	24	29	33	37	39	41	43	44	47	VNS (Garcia) [11]

Table 75: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_3 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.10	6.9	174	360	361	364	364	364	365	365	$\mathrm{ERT_{best}}$/D
ALPS-GA	**2.6**	30	11	40	59	59	61	64	**67**	81	ALPS-GA [17]
AMaLGaM IDEA	3.7	6.7	4.6	1320	38822	38527	38470	38458	38425	38370	AMaLGaM IDEA [4]
BayEDAcG	**2.1**	18	*22e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.5	3.4	3.6	311	5927	5882	5873	5871	5867	5858	BIPOP-CMA-ES [15]
BFGS	30	367	*70e+0/5e3*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	164	69	4088	*15e+0/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	4.3	14	389	*17e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	17	7.2	**1**	**11**	**19**	**19**	**19**	**19**	**19**	**20**	DASA [19]
DEPSO	**1.5**	8.0	172	*19e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	5.6	87	*26e+0/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**2.6**	34	18	1826	*20e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	9.3	14	*17e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.7**	71	*20e+0/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	**2.6**	146	26	**23**	73	141	463	609	827	3937	simple GA [22]
GLOBAL	**2.3**	6.8	142	*34e+0/2e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**2.7**	3.6	4.4	275	2284	2278	2287	2297	2304	2320	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.5**	**2.7**	**3.1**	62	*20e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	57	**2.2**	47	*11e+0/5e3*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	1335	46	**2.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**1.9**	5.6	3.9	43	79	79	79	79	79	**79**	MA-LS-Chain [21]
MCS	**1**	**1**	11	*40e-1/4e3*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	5.1	31	321	*90e-1/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	4.4	**1.1**	180	*11e+0/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	5.1	20	*23e+0/6e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	5.9	74	6369	*90e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	472	42	6.7	29	66	68	73	75	79	84	POEMS [20]
PSO	3.9	6.4	150	1814	1810	1796	1794	1794	1793	1791	PSO [7]
PSO_Bounds	**2.0**	11	50	44	**51**	**52**	**54**	**55**	70	95	PSO_Bounds [8]
Monte Carlo	**2.4**	2903	*63e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	18	327	*53e+0/8e3*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**2.0**	5.6	3.2	24	194	213	226	230	260	290	VNS (Garcia) [11]

Table 76: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_4 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.10	10	223	363	366	370	371	374	374	2877	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**2.4**	39	14	104	167	168	171	178	186	30	ALPS-GA [17]
AMaLGaM IDEA	**2.6**	8.9	41	*50e-1/1e6*	.	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	**2.1**	28	*18e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	5.8	**2.8**	6.5	*50e-1/3e5*	.	.	.	.	.	.	BIPOP-CMA-ES [15]
BFGS	89	854	*10e+1/5e3*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	189	104	*31e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	3.3	20	*33e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	134	7.8	**1**	**16**	**52**	**51**	**51**	**51**	**51**	**6.8**	DASA [19]
DEPSO	3.1	9.4	66	*18e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	4.2	180	*19e+0/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**2.5**	83	20	*50e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	35	13	*27e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**2.9**	504	*35e+0/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	**2.7**	140	22	**26**	**79**	305	1812	*84e-4/1e5*	.	.	simple GA [22]
GLOBAL	**2.5**	33	*57e+0/2e3*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	3.5	5.5	29	*50e-1/1e6*	.	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	6.5	**2.7**	6.6	*60e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	56	**1.6**	*21e+0/6e3*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	668	31	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	**2.8**	6.1	**5.1**	288	2022	2003	1997	1982	1978	257	MA-LS-Chain [21]
MCS	**1**	**1**	27	*12e+0/4e3*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	5.1	46	3273	*17e+0/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	3.1	**2.8**	*20e+0/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	11	106	*55e+0/7e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	9.5	121	62871	*15e+0/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	567	35	6.4	43	85	**89**	**91**	**94**	**97**	**13**	POEMS [20]
PSO	3.3	8.5	118	*80e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	3.5	28	37	186	197	196	197	199	211	30	PSO_Bounds [8]
Monte Carlo	**2.3**	19661	*86e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	32	778	*70e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	3.2	5.0	7.2	2893	25279	25063	26833	26633	26572	4560	VNS (Garcia) [11]

Table 77: Running time excess ERT/ERT$_{\text{best}}$ on f_5 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.10	1.6	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	ERT$_{\text{best}}$/D
ALPS-GA	**1**	7.4	125	192	222	238	249	251	255	258	ALPS-GA [17]
AMaLGaM IDEA	**1**	4.6	39	45	46	46	46	46	46	46	AMaLGaM IDEA [4]
BayEDAcG	**1**	5.9	91	122	137	138	138	138	138	138	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.2**	4.8	6.0	6.1	6.1	6.1	6.1	6.1	6.1	BIPOP-CMA-ES [15]
BFGS	**1**	**1.3**	**2.2**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	BFGS [30]
Cauchy EDA	**1**	24	68	70	72	72	72	72	72	72	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.1**	3.2	3.9	3.9	3.9	3.9	3.9	3.9	3.9	(1+1)-CMA-ES [2]
DASA	**1**	13	23	31	36	40	43	47	50	58	DASA [19]
DEPSO	**1**	7.0	33	47	50	50	50	50	50	50	DEPSO [12]
DIRECT	**1**	6.0	36	52	53	53	53	53	53	53	DIRECT [25]
EDA-PSO	**1**	**2.9**	11	17	20	20	21	21	21	21	EDA-PSO [6]
full NEWUOA	**1**	**2.8**	3.6	4.0	4.0	4.0	4.0	4.0	4.0	4.0	full NEWUOA [31]
G3-PCX	**1**	6.8	17	26	27	28	28	28	28	28	G3-PCX [26]
simple GA	**1**	5.8	1400	3142	5402	8245	11306	14687	18668	30154	simple GA [22]
GLOBAL	**1**	5.2	17	18	18	18	18	18	18	18	GLOBAL [23]
iAMaLGaM IDEA	**1**	**2.4**	8.8	11	12	12	12	12	12	12	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**2.2**	5.4	7.1	7.2	7.3	7.3	7.3	7.3	7.3	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	8.3	14	15	15	15	15	15	15	15	LSfminbnd [28]
LSstep	**1**	83	165	178	178	178	178	178	178	178	LSstep [28]
MA-LS-Chain	**1**	4.7	41	45	49	49	49	49	49	49	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1**	**1.6**	3.4	4.2	4.3	4.3	4.3	4.3	4.3	4.3	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.2**	3.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	NELDER (Doe) [5]
NEWUOA	**1**	**1.3**	**1.2**	**1.3**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	NEWUOA [31]
(1+1)-ES	**1**	**1.1**	**2.1**	**2.6**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	(1+1)-ES [1]
POEMS	**1**	134	195	231	257	265	267	268	268	268	POEMS [20]
PSO	**1**	**2.9**	13	17	19	19	20	20	20	20	PSO [7]
PSO_Bounds	**1**	3.1	10	14	15	15	16	16	16	16	PSO_Bounds [8]
Monte Carlo	**1**	11	*27e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.7	4.1	4.3	4.4	4.4	4.4	4.4	4.4	4.4	Rosenbrock [27]
VNS (Garcia)	**1**	5.6	10	10	11	11	11	11	11	11	VNS (Garcia) [11]

Table 78: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_6 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.8	10	41	62	83	104	129	157	184	237	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	30	24	31	42	51	59	64	67	68	87	ALPS-GA [17]
AMaLGaM IDEA	8.0	6.1	7.7	10	11	12	12	11	11	11	AMaLGaM IDEA [4]
BayEDAcG	23	20	352	*25e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.2**	3.6	**2.0**	**2.0**	**2.0**	**1.9**	**1.9**	**1.8**	**1.7**	**1.7**	BIPOP-CMA-ES [15]
BFGS	**2.9**	3.7	3.7	4.2	4.5	4.6	4.5	4.4	4.5	66	BFGS [30]
Cauchy EDA	692	546	182	153	139	129	119	110	105	99	Cauchy EDA [24]
(1+1)-CMA-ES	**1.7**	**1.4**	**1.1**	**2.5**	20	69	150	*21e-4/1e4*	.	.	(1+1)-CMA-ES [2]
DASA	15	10	72	146	345	494	572	621	670	701	DASA [19]
DEPSO	11	5.5	6.6	11	14	24	37	*50e-4/2e3*	.	.	DEPSO [12]
DIRECT	4.9	3.1	94	*34e-1/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	5.7	14	47	61	68	73	72	71	71	71	EDA-PSO [6]
full NEWUOA	**2.4**	**2.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	5.0	**2.2**	**1.6**	**2.3**	3.6	3.8	3.9	4.1	4.5	5.4	G3-PCX [26]
simple GA	156	80	136	4650	*28e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	9.3	4.6	3.1	3.3	3.5	3.4	3.4	3.3	4.0	83	GLOBAL [23]
iAMaLGaM IDEA	3.8	3.8	3.1	4.1	4.8	5.1	5.1	5.1	5.0	4.9	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.0	4.2	**2.1**	**2.3**	**2.4**	**2.4**	**2.4**	**2.3**	**2.2**	**2.1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	8.2	85	215	366	303	680	1115	919	787	*40e-1/1e4*	LSfminbnd [28]
LSstep	123	164	584	2381	*24e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	10	4.9	6.4	9.0	10	10	8.6	7.8	7.3	6.4	MA-LS-Chain [21]
MCS	**1.8**	3.6	18	174	169	280	*16e-1/4e3*	.	.	.	MCS [18]
NELDER (Han)	**1.8**	4.6	4.0	5.2	5.5	5.8	5.7	6.1	6.3	9.0	NELDER (Han) [16]
NELDER (Doe)	**1.3**	**1.1**	3.7	10	15	18	25	58	256	*14e-6/2e4*	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	**2.0**	3.2	4.0	4.9	5.5	5.9	5.9	6.2	NEWUOA [31]
(1+1)-ES	**2.0**	**2.8**	**1.7**	**1.9**	**2.1**	**2.5**	**2.4**	**2.4**	**2.4**	**2.6**	(1+1)-ES [1]
POEMS	92	36	29	40	44	46	46	45	44	45	POEMS [20]
PSO	4.9	4.7	383	413	317	258	213	182	159	129	PSO [7]
PSO_Bounds	4.8	5.6	44	116	144	151	142	130	128	161	PSO_Bounds [8]
Monte Carlo	1253	1533	*25e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.5**	**1**	10	37	41	37	34	33	31	29	Rosenbrock [27]
VNS (Garcia)	6.0	6.1	**2.5**	**2.4**	**2.3**	**2.2**	**2.1**	**2.0**	**1.9**	**1.8**	VNS (Garcia) [11]

Table 79: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_7 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.10	3.3	17	161	420	510	514	514	514	539	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.6**	15	25	10	25	57	59	59	59	56	ALPS-GA [17]
AMaLGaM IDEA	**1.5**	4.9	3.9	**1**	**2.3**	**2.6**	**2.6**	**2.6**	**2.6**	**2.5**	AMaLGaM IDEA [4]
BayEDAcG	**2.4**	13	23	*47e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.2	**2.8**	**2.3**	**1.2**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.2**	BIPOP-CMA-ES [15]
BFGS	14	150	*13e+1/100*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	93	50	31	7.2	4.4	4.7	4.9	4.9	4.9	4.9	Cauchy EDA [24]
(1+1)-CMA-ES	**2.5**	**2.1**	7.4	5.9	5.0	20	20	20	20	19	(1+1)-CMA-ES [2]
DASA	37	33	281	8760	*13e-1/6e5*	.	.	.	.	.	DASA [19]
DEPSO	**2.1**	6.6	9.2	21	32	*14e-1/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1.7**	16	68	*70e-2/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.7**	5.6	57	17	128	109	108	108	108	104	EDA-PSO [6]
full NEWUOA	3.7	**2.1**	**1**	7.6	105	*51e-2/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**2.1**	3.7	21	522	*19e-1/2e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**2.7**	23	136	267	676	2858	2834	2834	2834	*48e-2/1e5*	simple GA [22]
GLOBAL	**1.8**	6.1	11	50	*45e-1/500*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.8**	4.0	3.0	**1.0**	**1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.0**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.4**	**2.2**	**2.5**	**1.5**	**1.1**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	16	12	95	274	*40e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	109	161	721	*93e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**2.7**	4.8	7.7	15	110	116	116	116	116	111	MA-LS-Chain [21]
MCS	**1**	**1.3**	53	*50e-1/4e3*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	3.0	**1.4**	69	943	*11e-1/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	4.5	**1.1**	59	404	*19e-1/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	4.1	**1**	27	1041	*24e-1/1e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	6.3	**2.7**	187	6972	*85e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	1108	88	40	12	74	80	80	80	80	76	POEMS [20]
PSO	**2.2**	3.4	10	771	*11e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1.9**	4.2	19	726	3348	*13e-1/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**2.2**	32	59979	*94e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	152	403	*67e+0/3e3*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1.4**	8.3	3.2	4.1	19	31	34	34	34	33	VNS (Garcia) [11]

Table 80: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_8 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.2	13	33	92	111	122	127	129	132	134	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	53	43	43	104	143	207	270	368	468	2714	ALPS-GA [17]
AMaLGaM IDEA	10	7.4	7.3	11	12	12	12	12	13	13	AMaLGaM IDEA [4]
BayEDAcG	29	22	74	*93e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.0	**2.4**	**1.8**	4.1	4.2	4.3	4.3	4.4	4.5	4.6	BIPOP-CMA-ES [15]
BFGS	**1.9**	**2.3**	**1.7**	**1.5**	**1.3**	**1.3**	**1.3**	**1.2**	**1.2**	**1.2**	BFGS [30]
Cauchy EDA	111	82	65	101	95	92	93	94	96	100	Cauchy EDA [24]
(1+1)-CMA-ES	3.1	**2.9**	**1.9**	6.0	5.6	5.4	5.4	5.4	5.4	5.5	(1+1)-CMA-ES [2]
DASA	18	21	21	173	350	519	742	959	1171	1556	DASA [19]
DEPSO	11	9.0	11	*54e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	9.1	7.7	32	483	*64e-1/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	65	130	133	188	253	339	434	529	623	*46e-8/1e5*	EDA-PSO [6]
full NEWUOA	**2.8**	**2.0**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	4.6	3.5	**2.8**	6.1	5.7	5.6	5.5	5.5	5.5	5.7	G3-PCX [26]
simple GA	277	227	204	*53e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	7.7	3.2	**2.1**	**1.5**	**1.3**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	GLOBAL [23]
iAMaLGaM IDEA	6.5	4.7	3.9	7.3	7.4	7.4	7.5	7.7	7.8	8.2	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.2	**2.4**	**2.9**	6.6	6.3	6.1	6.1	6.2	6.2	6.3	IPOP-SEP-CMA-ES [29]
LSfminbnd	7.2	7.3	19	164	149	360	1107	1125	*40e-1/1e4*	.	LSfminbnd [28]
LSstep	140	80	63	157	396	1206	*12e-1/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	7.9	6.7	7.2	11	12	12	12	12	12	12	MA-LS-Chain [21]
MCS	**1.6**	**1**	**1.0**	**1.4**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	MCS [18]
NELDER (Han)	**1.6**	**2.5**	**1.9**	4.7	4.3	4.2	4.1	4.2	4.2	4.3	NELDER (Han) [16]
NELDER (Doe)	**2.2**	**1.3**	**1.3**	**2.2**	**2.7**	**2.9**	3.1	3.2	3.3	3.6	NELDER (Doe) [5]
NEWUOA	**1**	**1.4**	**1**	**1.5**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	NEWUOA [31]
(1+1)-ES	3.7	13	21	137	127	141	165	193	221	279	(1+1)-ES [1]
POEMS	80	59	63	410	705	*45e-3/1e5*	.	.	.	.	POEMS [20]
PSO	9.1	10	13	240	293	392	505	650	1244	5510	PSO [7]
PSO_Bounds	17	44	65	599	632	676	1406	11363	11353	*93e-5/1e5*	PSO_Bounds [8]
Monte Carlo	5417	*36e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.1**	3.6	12	51	68	87	139	259	356	1085	Rosenbrock [27]
VNS (Garcia)	10	5.6	3.5	7.4	7.3	7.2	7.2	7.3	7.3	7.4	VNS (Garcia) [11]

Table 81: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_9 in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.10	0.10	20	65	86	99	107	111	114	119	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	1728	5032	66	319	471	734	1919	3032	4433	61073	ALPS-GA [17]
AMaLGaM IDEA	346	702	9.3	17	15	15	15	15	15	16	AMaLGaM IDEA [4]
BayEDAcG	861	2522	56	*88e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	132	353	3.4	6.3	5.9	5.5	5.4	5.4	5.5	5.5	BIPOP-CMA-ES [15]
BFGS	88	228	**2.1**	**1.9**	**1.6**	**1.4**	**1.4**	**1.3**	**1.3**	**1.3**	BFGS [30]
Cauchy EDA	4402	9983	104	147	128	118	114	113	114	116	Cauchy EDA [24]
(1+1)-CMA-ES	103	350	3.3	7.7	6.6	6.1	5.9	5.8	5.8	5.8	(1+1)-CMA-ES [2]
DASA	755	16364	160	2185	2016	2370	2867	3726	4282	5773	DASA [19]
DEPSO	424	1113	15	*70e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	9.4	349	*17e-1/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	3225	17032	219	337	543	1526	*85e-4/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	140	249	**1.6**	**2.0**	**1.7**	**1.6**	**1.5**	**1.5**	**1.5**	**1.4**	full NEWUOA [31]
G3-PCX	186	473	4.7	15	12	11	10	10	10	10	G3-PCX [26]
simple GA	9021	28217	365	*79e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	326	447	**2.9**	**2.2**	**1.8**	**1.6**	**1.5**	**1.5**	**1.5**	**1.4**	GLOBAL [23]
iAMaLGaM IDEA	246	558	6.3	10	10	9.0	8.9	8.9	9.1	9.3	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	133	783	6.9	10	8.9	8.1	7.8	7.7	7.7	7.7	IPOP-SEP-CMA-ES [29]
LSfminbnd	230	1243	51	124	864	*14e-2/1e4*	.	.	.	.	LSfminbnd [28]
LSstep	5791	33263	416	*90e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	292	866	12	36	31	28	27	26	26	25	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	45	236	**2.4**	3.7	3.4	3.1	3.2	3.2	3.2	3.3	NELDER (Han) [16]
NELDER (Doe)	49	149	**2.7**	7.1	6.5	6.1	6.0	5.9	6.0	6.0	NELDER (Doe) [5]
NEWUOA	**39**	**145**	**1.7**	**1.7**	**1.4**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	NEWUOA [31]
(1+1)-ES	105	1602	9.5	229	191	195	217	244	275	335	(1+1)-ES [1]
POEMS	3095	6170	109	772	17260	*18e-2/1e5*	.	.	.	.	POEMS [20]
PSO	316	1728	24	844	1945	*11e-2/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	773	42812	455	1069	1607	*78e-3/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	3.74e5	*33e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	79	203	27	77	70	87	126	184	*12e-5/1e4*	.	Rosenbrock [27]
VNS (Garcia)	336	578	4.6	10	12	13	13	12	12	12	VNS (Garcia) [11]

Table 82: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{10} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	46	104	184	217	245	273	280	308	454	474	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	59	183	846	7806	*30e-1/5e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**2.9**	**2.2**	**1.8**	**1.9**	**2.0**	**2.0**	**2.2**	**2.2**	**1.6**	**1.9**	AMaLGaM IDEA [4]
BayEDAcG	*16e+3/2e3*	.	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.8	**2.7**	**2.3**	**2.1**	**1.9**	**1.8**	**1.8**	**1.7**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
BFGS	**1.8**	**1.3**	**1**	**1**	**1**	**1**	**1**	**1**	**1.3**	923	BFGS [30]
Cauchy EDA	22	14	10	11	11	12	13	13	10	11	Cauchy EDA [24]
(1+1)-CMA-ES	**2.8**	**2.1**	**1.7**	**1.8**	**1.7**	**1.6**	**1.5**	**1.4**	**1**	**1**	(1+1)-CMA-ES [2]
DASA	325	1465	7210	21501	61035	*76e-1/1e6*	.	.	.	.	DASA [19]
DEPSO	306	*19e+2/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	89	*37e+1/1e4*	.	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	299	829	*56e+0/1e5*	.	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1.9**	5.3	10	20	33	54	257	241	*79e-4/1e4*	.	full NEWUOA [31]
G3-PCX	6.1	6.9	10	19	26	30	37	40	31	38	G3-PCX [26]
simple GA	3461	13674	*12e+2/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**2.6**	**1.6**	**1.2**	**1.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.6**	*29e-7/1e3*	GLOBAL [23]
iAMaLGaM IDEA	**2.1**	**1.5**	**1.2**	**1.3**	**1.3**	**1.3**	**1.4**	**1.4**	**1.0**	**1.1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	9.3	5.6	4.0	3.7	3.4	3.2	3.2	**2.9**	**2.0**	**2.0**	IPOP-SEP-CMA-ES [29]
LSfminbnd	441	*14e+2/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	1590	*88e+2/1e4*	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	10	8.0	11	11	10	9.0	9.0	8.3	5.7	5.6	MA-LS-Chain [21]
MCS	167	*11e+2/4e3*	.	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**1.8**	**2.2**	4.1	16	43	100	237	824	1555	*27e-5/1e5*	NELDER (Han) [16]
NELDER (Doe)	**2.7**	3.7	9.5	25	34	57	334	972	*31e-4/2e4*	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.1**	3.8	6.0	7.4	10	11	9.2	12	NEWUOA [31]
(1+1)-ES	43	175	533	1079	1736	2388	3667	9065	10964	*43e-5/1e6*	(1+1)-ES [1]
POEMS	298	1287	*10e+1/1e5*	.	.	.	.	.	.	.	POEMS [20]
PSO	108	1049	3882	*74e+0/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	636	2177	*12e+1/1e5*	.	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*72e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	57	80	119	227	*22e+0/1e4*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	6.0	3.7	**2.8**	**2.7**	**2.5**	**2.3**	**2.3**	**2.2**	**1.5**	**1.5**	VNS (Garcia) [11]

Table 83: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.0	2.3	27	104	260	295	334	375	409	484	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	6.3	83	369	461	491	990	4306	*14e-4/5e5*	.	.	ALPS-GA [17]
AMaLGaM IDEA	5.5	14	**4.4**	**1.9**	**1.1**	**1.2**	**1.3**	**1.4**	**1.4**	**1.5**	AMaLGaM IDEA [4]
BayEDAcG	4.0	58	*62e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	6.0	82	13	3.8	**1.7**	**1.6**	**1.5**	**1.4**	**1.3**	**1.2**	BIPOP-CMA-ES [15]
BFGS	**2.2**	**7.1**	**1**	**1**	**1.7**	6.0	56	*12e-4/8e3*	.	.	BFGS [30]
Cauchy EDA	37	200	36	13	7.0	7.5	7.8	8.1	8.3	8.8	Cauchy EDA [24]
(1+1)-CMA-ES	**2.2**	42	10	3.8	**1.9**	**2.0**	**1.9**	**1.8**	**1.7**	**1.5**	(1+1)-CMA-ES [2]
DASA	5.9	852	1290	1004	754	1129	1402	1595	2034	3499	DASA [19]
DEPSO	7.1	139	*47e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1.8**	**7.9**	*20e+0/1e4*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	6.7	202	551	994	5674	*57e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	15	822	290	*31e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	5.7	65	40	22	14	16	17	18	19	21	G3-PCX [26]
simple GA	5.3	103	15812	*17e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	5.0	17	**2.5**	**1.7**	**1.5**	8.1	*11e-3/2e3*	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	5.0	25	5.7	**2.0**	**1**	**1**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	5.3	260	29	8.4	3.5	3.2	**2.9**	**2.6**	**2.4**	**2.1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.2**	9350	*13e+1/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	4.3	61142	*14e+1/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.0	31	39	14	6.0	5.6	5.1	4.6	4.3	3.8	MA-LS-Chain [21]
MCS	**1**	**1**	*30e+0/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	3.8	17	15	8.8	6.9	13	37	85	443	*24e-6/1e5*	NELDER (Han) [16]
NELDER (Doe)	5.2	17	13	7.8	5.4	10	17	34	93	*32e-6/2e4*	NELDER (Doe) [5]
NEWUOA	**1.4**	41	11	5.5	3.1	3.4	4.0	4.1	4.3	4.6	NEWUOA [31]
(1+1)-ES	835	20972	5324	2426	1328	1521	1703	1753	1910	2962	(1+1)-ES [1]
POEMS	86	198	216	204	141	160	208	274	346	1512	POEMS [20]
PSO	6.7	239	220	145	101	130	157	174	192	499	PSO [7]
PSO_Bounds	6.5	669	1447	923	673	1151	1437	3943	3635	*12e-2/1e5*	PSO_Bounds [8]
Monte Carlo	7.9	121	5.29e5	*12e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.3**	1036	5517	1416	567	499	442	394	361	305	Rosenbrock [27]
VNS (Garcia)	5.9	159	17	4.7	**2.0**	**1.9**	**1.7**	**1.6**	**1.5**	**1.3**	VNS (Garcia) [11]

Table 84: Running time excess ERT/ERT$_{\text{best}}$ on f_{12} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	21	28	52	90	124	139	157	197	366	515	ERT$_{\text{best}}$/D
ALPS-GA	86	84	57	120	206	1101	5370	10987	19321	*13e-4/5e5*	ALPS-GA [17]
AMaLGaM IDEA	14	13	8.5	6.6	6.6	7.9	9.1	9.2	5.9	5.3	AMaLGaM IDEA [4]
BayEDAcG	73	72	48	59	*71e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.7	3.3	3.7	4.6	5.3	5.6	5.6	5.2	3.1	**2.5**	BIPOP-CMA-ES [15]
BFGS	**1.5**	**1.3**	**1.3**	**1.4**	**1.4**	**1.3**	**1.3**	**2.2**	**2.6**	23	BFGS [30]
Cauchy EDA	102	106	84	69	68	71	74	68	42	34	Cauchy EDA [24]
(1+1)-CMA-ES	**2.0**	**2.3**	4.2	5.5	6.1	7.4	7.2	6.4	3.8	3.5	(1+1)-CMA-ES [2]
DASA	12	10	7065	44624	1.13e5	*39e-1/1e6*	.	.	.	.	DASA [19]
DEPSO	19	19	19	42	112	*55e-1/2e3*	.	.	.	.	DEPSO [12]
DIRECT	35	31	29	133	171	340	*64e-2/1e4*	.	.	.	DIRECT [25]
EDA-PSO	302	295	489	300	814	4793	*66e-3/1e5*	.	.	.	EDA-PSO [6]
full NEWUOA	**1.2**	**1.4**	**2.9**	4.1	4.6	6.2	6.6	6.2	4.4	4.7	full NEWUOA [31]
G3-PCX	**2.5**	**2.3**	**2.8**	3.7	4.0	4.4	4.6	4.1	**2.5**	**2.0**	G3-PCX [26]
simple GA	463	492	1306	1911	11473	*18e-1/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1.8**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2.9**	GLOBAL [23]
iAMaLGaM IDEA	7.7	7.2	5.0	4.8	4.9	5.4	5.7	5.5	3.4	**3.0**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.0	**2.9**	**3.0**	4.5	5.6	6.3	6.3	5.7	3.4	**2.7**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.6**	**2.4**	98	168	1129	1008	893	*51e-1/1e4*	.	.	LSfminbnd [28]
LSstep	74	67	170	730	*63e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	12	11	8.0	7.2	10	16	25	29	16	12	MA-LS-Chain [21]
MCS	**1.2**	**1**	3.2	3.9	7.0	11	13	27	76	113	MCS [18]
NELDER (Han)	**1.6**	**1.8**	**3.0**	4.7	5.3	5.3	5.4	4.8	**2.8**	**2.3**	NELDER (Han) [16]
NELDER (Doe)	**1.8**	**1.6**	3.0	6.0	7.2	7.6	7.7	6.9	4.3	6.5	NELDER (Doe) [5]
NEWUOA	**1.1**	**1.0**	**1.9**	**2.0**	**2.1**	**2.3**	**2.3**	**2.1**	**1.2**	**1**	NEWUOA [31]
(1+1)-ES	**1.9**	1571	14750	47844	*56e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	155	161	1077	2304	3289	*25e-1/1e5*	.	.	.	.	POEMS [20]
PSO	19	20	313	1683	5249	*41e-1/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	162	160	583	1772	3335	*27e-1/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*20e+5/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	27	38	336	1207	*14e-1/1e4*	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	4.4	5.1	4.9	5.6	17	16	15	12	6.9	5.2	VNS (Garcia) [11]

Table 85: Running time excess ERT/ERT$_{\text{best}}$ on f_{13} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	1.2	7.8	39	60	80	101	459	534	621	778	ERT$_{\text{best}}$/D
ALPS-GA	22	93	53	115	476	830	1150	3021	*54e-5/5e5*	.	ALPS-GA [17]
AMaLGaM IDEA	12	15	6.8	6.9	7.0	6.8	**1.8**	**1.8**	**1.8**	**1.8**	AMaLGaM IDEA [4]
BayEDAcG	17	99	230	*26e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.5	5.3	3.6	4.2	5.6	4.8	**1.3**	**1.3**	**1.5**	**1.8**	BIPOP-CMA-ES [15]
BFGS	**2.8**	**1.5**	**1**	**1**	**1**	**1**	86	*14e-4/1e4*	.	.	BFGS [30]
Cauchy EDA	160	129	46	43	42	41	11	11	11	11	Cauchy EDA [24]
(1+1)-CMA-ES	3.9	3.3	4.7	5.7	6.9	10	3.5	3.7	4.4	6.9	(1+1)-CMA-ES [2]
DASA	24	20	222	381	1176	3629	1786	2907	11146	*14e-5/1e6*	DASA [19]
DEPSO	8.8	19	58	*73e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**2.9**	22	62	163	585	*28e-2/1e4*	.	.	.	.	DIRECT [25]
EDA-PSO	5.9	301	142	155	991	2880	3093	*22e-3/1e5*	.	.	EDA-PSO [6]
full NEWUOA	6.2	**2.1**	**1.8**	12	25	66	40	135	*14e-4/1e4*	.	full NEWUOA [31]
G3-PCX	10	4.9	13	50	96	155	72	291	820	*26e-5/3e4*	G3-PCX [26]
simple GA	22	495	481	11186	*33e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	11	4.9	**1.7**	**1.4**	**1.3**	**1.2**	5.3	*23e-4/600*	.	.	GLOBAL [23]
iAMaLGaM IDEA	4.7	10	3.9	**3.8**	**3.9**	**3.8**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.2	5.2	8.7	10	9.2	8.4	**2.1**	**1.9**	**1.8**	**2.0**	IPOP-SEP-CMA-ES [29]
LSfminbnd	9.0	16	28	70	178	457	*53e-3/1e4*	.	.	.	LSfminbnd [28]
LSstep	249	300	472	750	1829	1456	*12e+0/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	6.6	19	16	33	138	160	50	43	43	43	MA-LS-Chain [21]
MCS	**1**	4.2	37	44	59	283	*86e-3/4e3*	.	.	.	MCS [18]
NELDER (Han)	**2.0**	3.8	4.4	9.1	15	21	5.9	6.2	9.0	13	NELDER (Han) [16]
NELDER (Doe)	**2.0**	**2.4**	7.2	16	40	76	64	162	479	*11e-4/2e4*	NELDER (Doe) [5]
NEWUOA	**2.3**	**1**	**2.0**	9.0	20	42	29	69	*20e-4/8e3*	.	NEWUOA [31]
(1+1)-ES	4.4	8.1	11	21	44	99	125	385	942	18971	(1+1)-ES [1]
POEMS	195	127	271	2007	5120	*31e-1/1e5*	.	.	.	.	POEMS [20]
PSO	6.0	25	953	10911	17587	13826	*44e-1/1e5*	.	.	.	PSO [7]
PSO_Bounds	5.2	98	2335	6783	17631	14117	*86e-1/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	25	*28e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	5.2	**2.0**	3.4	11	15	33	15	42	106	*31e-5/1e4*	Rosenbrock [27]
VNS (Garcia)	13	7.7	4.9	16	20	17	9.4	14	14	20	VNS (Garcia) [11]

Table 86: Running time excess ERT/ERT_{best} on f_{14} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.10	0.10	3.7	10	13	20	39	50	69	430	ERT_{best}/D
ALPS-GA	**1**	**2.7**	19	50	74	76	85	323	1365	*28e-7/5e5*	ALPS-GA [17]
AMaLGaM IDEA	**1**	3.1	4.7	9.0	13	12	8.5	8.4	7.5	**1.6**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**2.5**	7.8	75	109	207	*11e-3/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	9.2	**2.6**	3.3	3.8	4.1	4.3	4.9	5.2	**1.4**	BIPOP-CMA-ES [15]
BFGS	**1**	11	**1.6**	**1.6**	**1.6**	**1.4**	**1.0**	**1**	**1**	*11e-7/9e3*	BFGS [30]
Cauchy EDA	**1**	228	71	85	94	88	60	57	51	11	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	4.9	**2.0**	**1.9**	**2.3**	**2.4**	**2.5**	3.7	4.4	**1.1**	(1+1)-CMA-ES [2]
DASA	**1**	27	14	13	14	15	80	597	3576	*18e-7/1e6*	DASA [19]
DEPSO	**1.1**	**2.5**	6.6	10	15	21	33	*35e-5/2e3*	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.5**	11	50	108	497	*23e-4/1e4*	.	.	DIRECT [25]
EDA-PSO	**1**	4.0	4.2	125	244	252	173	193	1114	*68e-7/1e5*	EDA-PSO [6]
full NEWUOA	**1**	7.0	3.1	**1.8**	**2.0**	**1.7**	**1.4**	**2.8**	12	*37e-8/1e4*	full NEWUOA [31]
G3-PCX	**1**	**2.5**	3.9	**2.8**	**3.0**	3.1	**2.9**	5.5	16	122	G3-PCX [26]
simple GA	**1**	3.2	18	247	372	396	4250	*13e-4/1e5*	.	.	simple GA [22]
GLOBAL	**1.1**	3.1	8.0	3.7	3.1	**2.3**	**1.4**	**1.3**	**1.1**	*23e-7/300*	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	3.4	**2.2**	5.0	7.2	7.0	5.0	5.1	4.5	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	4.4	3.0	3.2	3.7	3.9	5.2	9.0	8.9	**2.0**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	45	7.5	5.5	5.6	8.1	52	*30e-5/1e4*	.	.	LSfminbnd [28]
LSstep	**1**	562	148	121	115	168	*29e-4/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**2.7**	4.4	8.3	12	13	13	15	16	3.6	MA-LS-Chain [21]
MCS	**1**	**1**	**1.1**	**2.4**	**2.9**	**2.8**	**2.8**	6.9	*32e-6/4e3*	.	MCS [18]
NELDER (Han)	**1**	3.7	**1.2**	**2.1**	**2.9**	**2.9**	**2.6**	3.2	**4.2**	8.8	NELDER (Han) [16]
NELDER (Doe)	**1**	4.9	**1.1**	**2.4**	**2.8**	3.5	3.7	4.5	6.3	43	NELDER (Doe) [5]
NEWUOA	**1**	7.2	**1**	**1**	**1**	**1**	**1**	**2.3**	7.3	566	NEWUOA [31]
(1+1)-ES	**1**	6.8	**2.2**	**2.0**	**2.2**	**2.3**	4.6	44	577	*82e-8/1e6*	(1+1)-ES [1]
POEMS	106	970	68	50	105	139	119	174	2950	*12e-6/1e5*	POEMS [20]
PSO	**1.1**	**2.9**	3.2	8.6	17	22	28	141	2053	*83e-7/1e5*	PSO [7]
PSO_Bounds	**1**	3.2	3.7	29	93	181	226	558	*13e-6/1e5*	.	PSO_Bounds [8]
Monte Carlo	**1**	**2.5**	17	*15e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	25	**2.1**	**1.3**	**1.4**	**1.7**	6.3	46	189	*96e-7/1e4*	Rosenbrock [27]
VNS (Garcia)	**1**	3.0	7.6	5.3	5.6	5.5	6.1	7.6	7.4	**1.8**	VNS (Garcia) [11]

Table 87: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{15} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.10	19	477	3925	7364	7467	7579	7674	7781	7983	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.9**	12	15	*30e-1/5e5*	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1.9**	**2.5**	**1**	**3.5**	**3.7**	**3.7**	**3.7**	**3.7**	**3.7**	**3.6**	AMaLGaM IDEA [4]
BayEDAcG	**1.8**	7.6	*28e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.9**	**1.0**	**1.0**	**1.7**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	BIPOP-CMA-ES [15]
BFGS	59	107	*70e+0/4e3*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	80	22	*16e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1.2**	**2.9**	147	*18e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	29	270	29495	*19e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1.6**	3.4	*37e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**2.2**	84	*17e+0/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**2.5**	23	7.0	167	191	189	186	184	182	177	EDA-PSO [6]
full NEWUOA	5.4	**2.6**	300	*21e+0/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.7**	104	1456	*24e+0/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1.7**	56	27	*41e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1.4**	13	*67e+0/900*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.7**	**1.6**	**2.6**	9.4	10	10	10	10	10	10	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.3**	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	14	14	*29e+0/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	455	311	*74e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.8**	**2.3**	3.6	23	98	96	95	94	92	90	MA-LS-Chain [21]
MCS	**1**	**1.7**	*24e+0/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	3.3	8.1	241	*99e-1/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**2.9**	3.7	47	*90e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	5.1	4.5	170	*22e+0/6e3*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	5.4	17	2132	*99e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	238	19	320	*11e+0/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	**1.6**	**2.1**	840	*23e+0/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1.7**	5.7	359	*11e+0/1e5*	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1.3**	1016	*68e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	13	710	*89e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1.6**	**1.8**	6.5	4267	6198	6113	6023	5949	5866	7664	VNS (Garcia) [11]

Table 88: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{16} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.10	0.10	43	703	1578	4567	5115	6511	6580	7157	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.5**	8.2	3.0	56	469	*23e-3/5e5*	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.4**	8.5	4.9	5.8	**4.5**	**5.1**	**4.2**	**4.2**	**3.9**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.3**	41	*95e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.1**	3.0	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	194	*18e+0/1e4*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	4.3	400	*76e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.3**	5.4	49	*12e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1.7**	185	2989	*11e-1/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	166	*11e+0/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**2.2**	**2.5**	**1.6**	**2.4**	10	*21e-3/1e4*	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.5**	55	126	190	95	131	103	102	95	EDA-PSO [6]
full NEWUOA	**1**	**1.1**	3.6	16	90	*99e-2/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.3**	4.7	69	*75e-2/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.5**	28	126	905	*91e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.3**	**1**	**1.7**	*11e-1/800*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	3.3	**1.8**	6.5	8.2	10	8.6	8.6	8.0	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.5**	**2.9**	**1.2**	**1.6**	**1.2**	**1.3**	**1.3**	**1.3**	**1.2**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.4**	7.9	*28e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**2.1**	51	*47e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.2**	**2.0**	16	462	*30e-2/5e4*	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**2.4**	17	86	*33e-1/4e3*	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1.5**	17	100	*75e-2/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.3**	**1.4**	23	*69e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**2.3**	4.7	*25e-1/9e3*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.6**	65	3736	*12e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	**1**	12	4.4	58	61	79	62	62	92	POEMS [20]
PSO	**1**	**1.4**	5.2	130	*92e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.5**	42	140	264	*89e-2/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.6**	43	*31e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**2.9**	770	*12e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.4**	4.1	3.7	28	37	182	371	671	1613	VNS (Garcia) [11]

Table 89: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{17} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.10	0.10	2.6	43	220	633	985	1534	2019	2650	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.2**	3.5	18	19	130	1134	*14e-4/5e5*	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**2.8**	3.8	**1.5**	**1.7**	**2.3**	**3.2**	**4.1**	**4.0**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.3**	4.0	11	6.4	7.3	*18e-3/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.4**	**1.6**	**1.1**	**1.7**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	79	53	*36e-1/8e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	56	67	35	27	12	9.4	6.9	6.2	6.6	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	3.9	14	621	*15e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	107	20179	*83e-2/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.5**	5.5	6.7	4.9	15	*28e-3/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.3**	3.7	7.2	23	*44e-4/1e4*	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.1**	**2.4**	44	22	13	11	9.4	8.8	9.4	EDA-PSO [6]
full NEWUOA	**1**	**2.1**	3.1	294	*95e-2/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.2**	**3.0**	5396	*15e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.5**	4.8	77	45	212	1458	*11e-3/1e5*	.	.	simple GA [22]
GLOBAL	**1**	**1.2**	3.9	*27e-1/2e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.6**	**1.8**	3.3	**2.2**	3.6	5.0	8.6	12	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1.6**	**1**	**1.1**	**1.3**	**1.3**	**1.0**	**1.0**	**1.1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	4.1	35	*26e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	108	959	*73e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.2**	**2.8**	5.0	8.9	15	21	21	26	53	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	1375	*18e-1/4e3*	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**2.4**	19	4181	6648	*11e-1/1e5*	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.2**	**1.2**	448	*77e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**2.9**	**1.4**	2145	*14e-1/2e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.9**	3518	*32e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	291	91	23	15	33	58	63	142	251	POEMS [20]
PSO	**1**	**1.3**	**1.6**	5.0	231	1030	*52e-3/1e5*	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.2**	**1.5**	29	322	1036	1435	*71e-3/1e5*	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	3.2	*21e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	15386	8272	*12e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	5.7	**1.4**	**1**	**2.2**	7.7	28	326	*39e-8/7e6*	VNS (Garcia) [11]

Table 90: Running time excess ERT/ERT$_{\text{best}}$ on f_{18} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.10	0.19	24	84	701	1593	2754	3161	3723	4271	ERT$_{\text{best}}$/D
ALPS-GA	**1**	3.2	13	20	60	4705	*19e-3/5e5*	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1.2**	**1.8**	**2.9**	**2.8**	**1.4**	**1.5**	**2.2**	**2.3**	**2.7**	**2.4**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**2.3**	8.8	13	6.4	19	*17e-2/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	3.1	**1**	**1**	**1**	**1**	**1.2**	**1.1**	**1.1**	**1.2**	BIPOP-CMA-ES [15]
BFGS	**1.7**	157	4960	*16e+0/8e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.1**	111	31	24	5.2	3.6	**2.8**	**3.0**	3.1	4.1	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	4.0	109	*40e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1.4**	17	1371	80675	*19e-1/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	4.4	4.3	10	13	*19e-2/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1.0**	**2.3**	8.1	4.2	28	*38e-3/1e4*	.	.	.	DIRECT [25]
EDA-PSO	**1**	**2.1**	28	42	9.2	6.0	7.5	21	79	*43e-6/1e5*	EDA-PSO [6]
full NEWUOA	**1.1**	13	122	1710	*39e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.1**	**1.6**	795	*51e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	57	85	124	*88e-3/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.9**	84	*90e-1/2e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**2.1**	**1.6**	3.3	**1.4**	**2.9**	3.1	4.8	6.5	9.1	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	3.3	4.4	**2.8**	**1.2**	**1.1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	15	212	*66e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1.1**	226	*19e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	3.4	**2.5**	6.1	12	49	255	*13e-3/5e4*	.	.	MA-LS-Chain [21]
MCS	**1**	**1.0**	57	*51e-1/4e3*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	3.5	506	8354	*32e-1/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.1**	**2.8**	72	3544	*34e-1/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1.1**	99	558	*51e-1/4e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**2.0**	10	2.79e5	*14e+0/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**2.1**	528	19	28	42	130	239	446	*24e-3/1e5*	.	POEMS [20]
PSO	**1**	**1.7**	3.5	2401	1998	*11e-1/1e5*	.	.	.	.	PSO [7]
PSO_Bounds	**1.1**	**2.5**	10	139	581	883	*38e-2/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.4**	3329	*72e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	8663	*40e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**2.7**	**1.7**	**1.1**	**1.8**	22	93	1547	*85e-6/6e6*	.	VNS (Garcia) [11]

Table 91: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{19} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.10	0.10	0.10	0.10	1061	98379	1.37e5	1.37e5	1.38e5	1.39e5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	405	77011	549	*74e-3/5e5*	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	160	**7346**	83	**7.7**	**8.8**	**8.7**	**8.7**	**8.6**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.3**	211	*20e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	52	9423	**10**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	**1.7**	19206	*51e-1/8e3*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	6.8	1401	3.42e6	*14e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	63	87495	*55e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1.1**	7112	1.45e7	*13e-1/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	206	*29e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	**16**	*11e-2/1e4*	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.1**	129	3.72e5	1333	*73e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.4**	146	1.38e5	*11e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	35932	1.45e6	*16e-1/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.1**	1004	1.74e5	293	*14e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.2**	372	1.17e5	*15e-1/2e3*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	78	2.51e5	368	**73**	**109**	**108**	**108**	**107**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	54	16271	17	*10e-2/1e4*	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	3.1	200	1.42e6	*18e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	55	2658	*17e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	123	8607	87	*13e-2/5e4*	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	*16e-3/4e3*	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1**	28	27916	*24e-2/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.1**	**24**	12163	*26e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**2.1**	27	3.18e5	*63e-2/1e5*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.5**	6541	2.84e7	*18e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	377	2513	2.13e5	1374	*57e-2/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1.3**	113	3.66e5	*51e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.1**	122	9.19e5	*57e-2/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	500	*31e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**2.5**	6.50e5	*24e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.4**	219	31178	1927	*60e-3/5e6*	.	.	.	.	VNS (Garcia) [11]

Table 92: Running time excess ERT/ERT$_{\text{best}}$ on f_{20} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	2.6	3.0	3.2	1543	55001	56739	57252	57645	58096	58926	ERT$_{\text{best}}$/D
ALPS-GA	31	52	61	**1.5**	10	10	10	10	10	10	ALPS-GA [17]
AMaLGaM IDEA	8.1	10	11	18	271	263	260	258	256	253	AMaLGaM IDEA [4]
BayEDAcG	16	22	30	*27e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.4	5.1	5.5	3.6	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1.6**	**1.9**	**2.4**	**1.1**	*65e-2/1e4*	.	.	.	.	.	BFGS [30]
Cauchy EDA	106	136	143	*21e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**2.9**	3.2	3.3	3.3	*83e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	27	29	30	**1.9**	268	260	258	256	254	250	DASA [19]
DEPSO	11	14	15	**1.1**	*68e-2/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	7.2	17	16	*14e-1/1e4*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	15	44	92	7.8	3.8	3.7	3.7	**3.7**	**3.7**	**3.7**	EDA-PSO [6]
full NEWUOA	**2.6**	**2.2**	**2.1**	10	*10e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	5.8	6.0	6.1	12	*85e-2/5e4*	.	.	.	.	.	G3-PCX [26]
simple GA	126	308	362	3.2	**1.8**	**2.0**	**2.6**	25	*18e-4/1e5*	.	simple GA [22]
GLOBAL	12	11	11	**2.6**	*11e-1/1e3*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	4.8	5.8	6.2	38	*24e-2/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.4	4.6	4.8	3.1	*55e-2/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	10	11	13	3.5	*81e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	201	250	301	8.3	*98e-2/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.4	8.5	9.3	**2.2**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	MA-LS-Chain [21]
MCS	4.8	4.6	4.4	**1**	*77e-2/4e3*	.	.	.	.	.	MCS [18]
NELDER (Han)	**1.5**	**1.9**	**2.3**	16	*75e-2/1e5*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.7**	**2.1**	**2.3**	5.7	*81e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	**1.9**	*69e-2/1e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**2.7**	3.0	3.1	7.2	*47e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	95	95	97	**1.1**	12	12	12	12	12	12	POEMS [20]
PSO	6.8	8.9	10	**1.5**	*57e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	9.4	29	38	**2.0**	5.1	7.1	7.1	7.1	7.0	7.4	PSO_Bounds [8]
Monte Carlo	211	2420	8239	*29e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	3.0	3.1	3.1	**1.7**	*67e-2/1e4*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	11	11	11	**1.2**	52	50	50	49	49	51	VNS (Garcia) [11]

Table 93: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_{21} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.10	0.10	13	224	439	449	462	486	507	1133	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	**1**	21	**4.5**	5.0	5.8	6.6	7.3	8.0	4.6	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	27	139	118	116	113	109	105	48	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	48	27	32	*19e-1/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	5.9	28	16	15	15	14	14	6.3	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	4.6	**2.9**	**2.8**	**2.7**	**2.7**	**2.6**	**2.5**	**2.0**	BFGS [30]
Cauchy EDA	**1**	**1**	79	343	316	310	302	287	275	124	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	10	6.1	5.1	5.0	4.9	4.6	4.5	**2.0**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	172	498	430	421	409	389	373	167	DASA [19]
DEPSO	**1**	**1**	11	26	19	19	18	18	17	7.8	DEPSO [12]
DIRECT	**1**	**1**	**2.5**	7.5	17	36	35	33	34	17	DIRECT [25]
EDA-PSO	**1**	**1**	53	1238	915	898	874	833	799	359	EDA-PSO [6]
full NEWUOA	**1**	**1**	4.4	7.3	4.4	4.3	4.2	4.0	3.8	**1.7**	full NEWUOA [31]
G3-PCX	**1**	**1**	5.0	13	9.0	8.8	8.6	8.2	7.8	3.5	G3-PCX [26]
simple GA	**1**	**1**	91	85	95	97	126	125	123	260	simple GA [22]
GLOBAL	**1**	**1**	3.6	**1**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	3.2	49	44	44	43	41	40	18	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	5.9	14	10	10	10	9.5	9.1	4.1	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	99	105	166	163	158	151	144	65	LSfminbnd [28]
LSstep	**1**	**1**	688	634	327	323	317	304	294	*91e-1/1e4*	LSstep [28]
MA-LS-Chain	**1**	**1**	7.5	66	43	42	41	39	38	17	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	20	10	10	10	10	9.1	4.9	MCS [18]
NELDER (Han)	**1**	**1**	20	16	16	16	15	14	14	6.2	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	8.4	6.0	**3.7**	**3.6**	**3.5**	**3.4**	**3.3**	**1.6**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**2.1**	7.4	4.8	4.7	4.6	4.4	4.2	**1.9**	NEWUOA [31]
(1+1)-ES	**1**	**1**	10	20	18	18	17	17	16	7.1	(1+1)-ES [1]
POEMS	**1**	**1**	295	1792	1482	1452	1412	1344	1287	577	POEMS [20]
PSO	**1**	**1**	1186	512	342	335	326	310	297	133	PSO [7]
PSO_Bounds	**1**	**1**	558	1233	1484	1454	1414	1346	1291	580	PSO_Bounds [8]
Monte Carlo	**1**	**1**	572	63491	*20e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	16	18	12	12	12	11	11	4.8	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	10	22	30	46	66	68	68	32	VNS (Garcia) [11]

Table 94: Running time excess ERT/ERT$_{\text{best}}$ on f_{22} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.10	0.10	10	284	635	662	680	692	830	1035	ERT$_{\text{best}}$/D
ALPS-GA	**1**	**1**	33	7.0	12	15	18	24	24	27	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	8.8	488	4883	4702	4584	4502	3759	3015	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	62	31	*20e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	29	58	201	193	188	184	154	123	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	6.6	3.1	4.4	4.2	4.2	4.1	3.5	5.7	BFGS [30]
Cauchy EDA	**1**	**1**	454	359	*20e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	9.3	3.7	3.4	3.3	3.2	3.2	**2.7**	**2.2**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	321	218	192	187	185	186	158	136	DASA [19]
DEPSO	**1**	**1**	66	47	*51e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**3.5**	5.1	*69e-2/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	1644	979	*20e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	3.6	**1.1**	**1.9**	**1.8**	**1.8**	**1.8**	**1.5**	**1.3**	full NEWUOA [31]
G3-PCX	**1**	**1**	9.3	5.6	5.6	5.5	5.4	5.3	4.5	3.7	G3-PCX [26]
simple GA	**1**	**1**	130	722	*20e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	4.5	**1**	**1**	**1**	**1**	**1**	**1**	**1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	24	167	1197	1152	1124	1106	925	745	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	22	61	222	213	207	204	170	136	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	174	26	48	47	48	49	42	72	LSfminbnd [28]
LSstep	**1**	**1**	332	89	234	*20e-1/1e4*	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	55	505	537	515	502	493	412	330	MA-LS-Chain [21]
MCS	**1**	**1**	**1.1**	3.2	6.4	6.1	6.0	5.9	4.9	12	MCS [18]
NELDER (Han)	**1**	**1**	**1**	7.4	10	10	9.4	9.3	7.8	6.2	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	18	**2.5**	5.0	4.9	4.9	4.8	4.0	3.3	NELDER (Doe) [5]
NEWUOA	**1**	**1**	6.7	**1.8**	**2.5**	**2.4**	**2.4**	**2.4**	**2.0**	**1.7**	NEWUOA [31]
(1+1)-ES	**1**	**1**	47	17	13	13	13	13	11	8.9	(1+1)-ES [1]
POEMS	**1**	**1**	4427	1414	1026	986	961	945	789	636	POEMS [20]
PSO	**1**	**1**	3726	1410	2204	2117	2063	2030	1698	1367	PSO [7]
PSO_Bounds	**1**	**1**	745	1413	2206	2120	2094	2074	1742	1404	PSO_Bounds [8]
Monte Carlo	**1**	**1**	2471	*20e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	35	5.0	5.4	5.3	5.3	5.4	4.7	4.1	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	39	158	1054	1425	1479	1459	1221	981	VNS (Garcia) [11]

Table 95: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_{23} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget $\mathrm{ERT_{best}}$/D	1e+03 0.10	1e+02 0.10	1e+01 0.28	1e+00 92	1e-01 1643	1e-02 18390	1e-03 20350	1e-04 20641	1e-05 20893	1e-07 21351	Δftarget $\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	**1**	**1.7**	42	1049	*14e-2/5e5*	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.6**	10	**1**	**1**	**1.0**	**1.0**	**1.0**	**1.0**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.3**	*16e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**2.0**	21	**2.7**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	17	128	*11e-1/5e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	**2.3**	1664	*11e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	3.4	**2.9**	*22e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	5.0	28	4251	*15e-2/1e6*	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	**1.7**	*18e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**2.1**	**2.1**	*65e-2/1e4*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	**1.7**	589	*87e-2/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	13	**2.9**	44	*19e-2/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1**	**1.8**	4.9	98	*19e-2/4e4*	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	**1.4**	393	*85e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**2.1**	**1**	*32e-2/700*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.8**	5.7	**3.6**	**1.1**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**2.4**	17	12	*11e-2/1e4*	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	**2.1**	26	*66e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	**1.2**	31	*51e-2/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**2.0**	**2.3**	17	38	35	*44e-3/5e4*	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	3.4	15	*56e-2/4e3*	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1**	**1**	5.7	40	80	*59e-3/1e5*	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.7**	**1.4**	11	*97e-3/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	7.5	3.6	*34e-2/7e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	4.4	7.6	2873	*14e-2/1e6*	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	**1**	15	31	19	36	69	*63e-3/1e5*	.	.	POEMS [20]
PSO	**1**	**1**	**1.7**	91	*42e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1**	**1.5**	131	*67e-2/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**1.6**	532	*61e-2/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**2.1**	**2.2**	*32e-2/5e3*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**2.6**	18	34	139	423	677	669	655	VNS (Garcia) [11]

Table 96: Running time excess ERT/$\mathrm{ERT_{best}}$ on f_{24} in **10-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT_{best}}$/D	0.10	6.6	9876	1.04e5	7.47e6	7.48e6	7.48e6	7.48e6	7.48e6	7.48e6	$\mathrm{ERT_{best}}$/D
ALPS-GA	**1**	24	10	*44e-1/5e5*	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	5.5	18	**8.3**	***78e-2/1e6***	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	**1**	19	*37e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.2**	**2.7**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	346	*81e+0/4e3*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	51	*27e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	8.6	14	*20e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	1321	*31e+0/1e6*	.	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	6.8	*38e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	5.9	*19e+0/1e4*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	56	*23e+0/1e5*	.	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**2.6**	*16e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	16	*31e+0/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	123	*14e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	7.2	*62e+0/1e3*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	4.2	4.2	**4.2**	***66e-2/1e6***	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**2.2**	**1**	*91e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	20	*33e+0/1e4*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	3.0	171	*49e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	5.7	*11e+0/5e4*	.	.	.	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	15	*30e+0/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	8.2	22	*11e+0/1e5*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	4.7	**2.6**	*96e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	*26e+0/7e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	141	745	*17e+0/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	48	142	*19e+0/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	**1**	8.1	142	*20e+0/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	22	144	*22e+0/1e5*	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	824	*60e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	10428	*12e+1/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	4.8	3.7	*21e-1/8e6*	.	.	.	.	.	.	VNS (Garcia) [11]

Table 97: Running time excess ERT/ERT_{best} on f_1 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	0.05	0.28	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	ERT_{best}/D
ALPS-GA	**1**	64	148	318	515	706	916	1137	1357	1849	ALPS-GA [17]
AMaLGaM IDEA	**1**	58	55	132	199	263	324	386	442	547	AMaLGaM IDEA [4]
BayEDAcG	**1**	49	106	204	307	409	496	607	705	1040	BayEDAcG [10]
BIPOP-CMA-ES	**1**	9.2	7.9	14	20	26	33	39	45	57	BIPOP-CMA-ES [15]
BFGS	**1**	**7.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BFGS [30]
Cauchy EDA	**1**	844	731	1626	2521	3523	4337	5224	6130	7800	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	12	5.4	9.2	13	17	21	25	29	37	(1+1)-CMA-ES [2]
DASA	**1**	60	26	45	66	86	118	152	198	295	DASA [19]
DEPSO	**1**	31	30	81	188	329	557	805	1446	*44e-7/2e3*	DEPSO [12]
DIRECT	**1**	8.6	48	112	225	357	485	677	874	1393	DIRECT [25]
EDA-PSO	**1**	19	454	1067	1682	2287	2927	3556	4201	5441	EDA-PSO [6]
full NEWUOA	**1**	41	5.4	**5.4**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	full NEWUOA [31]
G3-PCX	**1**	31	8.0	13	18	23	27	32	37	48	G3-PCX [26]
simple GA	**1**	130	876	1905	3205	11988	30562	1.96e5	6.73e5	*74e-5/1e5*	simple GA [22]
GLOBAL	**1**	37	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	GLOBAL [23]
iAMaLGaM IDEA	**1**	13	27	57	88	116	145	178	206	267	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	13	7.1	12	18	23	29	34	39	50	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	43	9.3	10	10	10	10	10	10	10	LSfminbnd [28]
LSstep	**1**	848	164	175	176	177	177	177	177	177	LSstep [28]
MA-LS-Chain	**1**	19	21	51	78	103	122	143	160	196	MA-LS-Chain [21]
MCS	**1**	**1**	**2.4**	6.4	6.8	7.0	7.0	7.0	7.0	7.0	MCS [18]
NELDER (Han)	**1**	9.1	5.2	12	19	27	32	36	40	49	NELDER (Han) [16]
NELDER (Doe)	**1**	**6.8**	3.3	6.7	11	16	21	27	32	40	NELDER (Doe) [5]
NEWUOA	**1**	7.5	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	NEWUOA [31]
(1+1)-ES	**1**	11	4.9	8.1	11	15	18	22	25	31	(1+1)-ES [1]
POEMS	**1**	828	184	403	874	1377	1787	2332	2794	3779	POEMS [20]
PSO	**1**	16	22	3399	3446	3507	3563	3620	3680	3808	PSO [7]
PSO_Bounds	**1**	19	123	1490	2136	2779	3330	3795	4509	16031	PSO_Bounds [8]
Monte Carlo	**1**	172	*29e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	19	3.8	5.8	7.2	9.1	11	12	14	17	Rosenbrock [27]
VNS (Garcia)	**1**	28	10	17	23	29	36	41	48	60	VNS (Garcia) [11]

Table 98: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_2 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	19	19	19	19	19	19	19	20	20	20	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	45	66	88	113	136	163	190	220	256	366	ALPS-GA [17]
AMaLGaM IDEA	22	29	35	43	50	56	62	68	76	88	AMaLGaM IDEA [4]
BayEDAcG	31	42	54	64	76	94	104	*34e-5/2e3*	.	.	BayEDAcG [10]
BIPOP-CMA-ES	15	26	35	40	44	45	47	47	48	50	BIPOP-CMA-ES [15]
BFGS	9.1	15	20	24	26	27	27	27	28	28	BFGS [30]
Cauchy EDA	189	308	415	510	612	705	797	900	991	1207	Cauchy EDA [24]
(1+1)-CMA-ES	14	22	30	37	39	41	41	42	43	44	(1+1)-CMA-ES [2]
DASA	5.6	7.8	10	14	18	23	28	34	39	49	DASA [19]
DEPSO	12	23	42	66	108	502	*39e-3/2e3*	.	.	.	DEPSO [12]
DIRECT	38	53	134	471	487	505	537	1189	*14e-1/5e3*	.	DIRECT [25]
EDA-PSO	204	267	332	400	472	538	604	675	739	876	EDA-PSO [6]
full NEWUOA	23	94	448	3769	*47e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	15	47	127	209	319	418	547	650	760	985	G3-PCX [26]
simple GA	304	461	3231	6772	73495	*29e-1/1e5*	.	.	.	.	simple GA [22]
GLOBAL	8.4	13	18	23	26	30	33	49	51	63	GLOBAL [23]
iAMaLGaM IDEA	11	17	22	27	30	33	36	40	43	49	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.8	6.2	7.5	8.3	9.1	**10**	**10**	**11**	**11**	**13**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSfminbnd [28]
LSstep	17	17	17	17	17	17	17	17	17	17	LSstep [28]
MA-LS-Chain	7.6	11	15	19	23	27	32	36	43	76	MA-LS-Chain [21]
MCS	**1.0**	**2.2**	**5.4**	14	21	41	43	45	45	*30e-8/4e3*	MCS [18]
NELDER (Han)	4.3	6.0	7.0	**7.8**	**8.6**	**9.2**	**10**	**10**	**11**	**12**	NELDER (Han) [16]
NELDER (Doe)	5.3	8.5	13	17	19	23	28	32	36	48	NELDER (Doe) [5]
NEWUOA	**1.9**	6.8	18	42	71	92	125	148	174	219	NEWUOA [31]
(1+1)-ES	268	1765	6943	15563	26382	37913	74087	1.81e5	3.75e5	*59e-5/1e6*	(1+1)-ES [1]
POEMS	148	194	246	296	340	410	453	502	558	661	POEMS [20]
PSO	16	1939	4580	4572	4571	4564	4547	4545	4542	4533	PSO [7]
PSO_Bounds	123	232	361	528	835	1400	1751	2109	2272	2566	PSO_Bounds [8]
Monte Carlo	*12e+4/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.0**	**1.2**	**1.4**	**1.6**	**5.8**	18	29	66	73	73	Rosenbrock [27]
VNS (Garcia)	35	57	72	82	88	95	97	98	98	99	VNS (Garcia) [11]

Table 99: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_3 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	13	253	381	382	382	382	382	382	383	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	19	54	50	186	231	242	271	315	398	3247	ALPS-GA [17]
AMaLGaM IDEA	17	43	27	*40e-1/1e6*	.	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	**15**	85	*73e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	25	6.7	12	*40e-1/3e5*	.	.	.	.	.	.	BIPOP-CMA-ES [15]
BFGS	568	*28e+1/6e3*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	2865	446	*69e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	37	841	*92e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	208	5.9	**1**	**8.3**	**35**	**35**	**35**	**35**	**36**	**36**	DASA [19]
DEPSO	42	126	*84e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	28	*43e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	22	146	44	*70e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	176	648	*88e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	24	11865	*13e+1/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	26	194	29	3709	*21e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	19	1441	*15e+1/2e3*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	24	19	38	17649	*20e-1/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	28	**5.2**	10	*60e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	188	**1.3**	*19e+0/6e3*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	4002	27	**1.5**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	20	12	**7.0**	95	158	158	158	158	158	**158**	MA-LS-Chain [21]
MCS	**1**	**1**	28	*13e+0/4e3*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	42	260	*81e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	24	71	*47e+0/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	41	7468	*13e+1/6e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	360	22627	*81e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	3953	43	10	**69**	**141**	**143**	**146**	**150**	**153**	158	POEMS [20]
PSO	19	21	*21e+0/1e5*	.	.	.	.	.	.	.	PSO [7]
PSO_Bounds	28	326	118	192	360	361	363	378	403	428	PSO_Bounds [8]
Monte Carlo	32	*26e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	565	*23e+1/7e3*	.	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	20	8.1	8.3	345	487	523	560	623	629	630	VNS (Garcia) [11]

Table 100: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_4 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	37	236	381	383	384	385	386	388	7053	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	92	29	146	9772	*30e-1/2e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	79	20	*14e+0/1e6*	.	.	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	83	40	*69e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	37	**2.4**	*12e+0/3e5*	.	.	.	.	.	.	.	BIPOP-CMA-ES [15]
BFGS	1712	*40e+1/8e3*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	5136	4300	*11e+1/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	46	*14e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	286	**2.1**	**1**	**129**	1676	1672	1669	1664	1657	91	DASA [19]
DEPSO	120	123	*10e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	11	*88e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**20**	56	5955	*15e+0/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	272	3998	*13e+1/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	79	*19e+1/5e4*	.	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	103	80	65	3751	*34e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	155	*20e+1/4e3*	.	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	61	7.1	*13e+0/1e6*	.	.	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	55	**2.5**	*14e+0/1e4*	.	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	278	**1.2**	*49e+0/7e3*	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	4403	9.5	**1.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	LSstep [28]
MA-LS-Chain	60	6.2	53	*30e-1/1e5*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	*21e+0/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	40	*13e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	35	1611	*11e+1/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	55	4309	*17e+1/1e4*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	82	3.81e5	*13e+1/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	4046	18	**13**	**143**	**218**	**243**	**246**	**248**	**250**	**14**	POEMS [20]
PSO	44	8.6	5940	*23e+0/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	66	131	186	286	**296**	**358**	**359**	**373**	**378**	**21**	PSO_Bounds [8]
Monte Carlo	134	*33e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	651	*20e+1/8e3*	.	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	105	3.2	27	27751	1.30e5	1.30e5	*20e-1/4e6*	.	.	.	VNS (Garcia) [11]

Table 101: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_5 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	51	159	209	248	275	295	308	325	328	ALPS-GA [17]
AMaLGaM IDEA	**1**	34	75	80	80	80	80	80	80	80	AMaLGaM IDEA [4]
BayEDAcG	**1**	67	154	197	205	205	206	206	206	206	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**2.7**	5.1	6.2	6.3	6.3	6.3	6.3	6.3	6.3	BIPOP-CMA-ES [15]
BFGS	**1**	**1.4**	**2.4**	**2.7**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	BFGS [30]
Cauchy EDA	**1**	114	164	166	166	166	166	166	166	166	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.6**	3.1	3.6	3.7	3.7	3.7	3.7	3.7	3.7	(1+1)-CMA-ES [2]
DASA	**1**	14	24	29	34	38	43	47	52	64	DASA [19]
DEPSO	**1**	16	39	46	48	48	48	48	48	48	DEPSO [12]
DIRECT	**1**	62	180	224	226	226	226	226	226	226	DIRECT [25]
EDA-PSO	**1**	5.2	27	34	37	39	39	39	39	39	EDA-PSO [6]
full NEWUOA	**1**	6.4	6.2	6.5	6.6	6.6	6.6	6.6	6.6	6.6	full NEWUOA [31]
G3-PCX	**1**	7.5	19	25	26	27	27	27	27	27	G3-PCX [26]
simple GA	**1**	572	2158	4592	7519	10643	14125	18035	22238	2.30e5	simple GA [22]
GLOBAL	**1**	9.5	10	11	11	11	11	11	11	11	GLOBAL [23]
iAMaLGaM IDEA	**1**	4.4	10	11	11	11	11	11	11	11	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**2.9**	6.2	7.3	7.7	7.7	7.7	7.7	7.7	7.7	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	14	16	16	16	16	16	16	16	16	LSfminbnd [28]
LSstep	**1**	155	185	187	187	187	187	187	187	187	LSstep [28]
MA-LS-Chain	**1**	22	41	44	46	46	46	46	46	46	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	MCS [18]
NELDER (Han)	**1**	3.8	7.4	8.8	9.2	9.2	9.2	9.2	9.2	9.2	NELDER (Han) [16]
NELDER (Doe)	**1**	**2.6**	5.2	6.2	6.3	6.4	6.4	6.4	6.4	6.4	NELDER (Doe) [5]
NEWUOA	**1**	**1.2**	**1.2**	**1.5**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	NEWUOA [31]
(1+1)-ES	**1**	**1.6**	3.1	3.5	3.6	3.6	3.6	3.6	3.6	3.6	(1+1)-ES [1]
POEMS	**1**	178	256	312	335	347	350	353	354	354	POEMS [20]
PSO	**1**	4.7	43116	43121	43122	43124	43125	43125	43125	43125	PSO [7]
PSO_Bounds	**1**	4.5	156	158	159	160	160	160	160	160	PSO_Bounds [8]
Monte Carlo	**1**	2.49e6	*11e+1/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.8	4.2	4.3	4.3	4.3	4.3	4.3	4.3	4.3	Rosenbrock [27]
VNS (Garcia)	**1**	4.9	6.8	7.6	7.8	7.8	7.8	7.8	7.8	7.8	VNS (Garcia) [11]

Table 102: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_6 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.0	26	65	117	171	213	261	298	336	420	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	59	25	34	40	46	55	72	112	269	*14e-7/2e5*	ALPS-GA [17]
AMaLGaM IDEA	26	22	19	16	15	16	16	16	16	16	AMaLGaM IDEA [4]
BayEDAcG	46	41	*60e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.9**	**2.2**	**1.5**	**1.3**	**1.2**	**1.1**	**1.1**	**1.1**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
BFGS	**2.2**	**2.7**	3.6	3.5	3.4	3.5	3.5	3.6	3.6	45	BFGS [30]
Cauchy EDA	6221	1501	1029	1266	*17e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1.9**	4.5	13	131	835	*13e-1/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	12	6.8	10	14	18	24	35	43	46	54	DASA [19]
DEPSO	11	7.5	12	48	*13e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	18	31	*40e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	27	46	40	34	31	32	31	32	32	33	EDA-PSO [6]
full NEWUOA	5.0	**1.9**	**1.4**	**1.1**	**1.0**	**1**	**1**	**1**	**1**	**1**	full NEWUOA [31]
G3-PCX	4.1	**1.4**	**1.4**	**1.5**	**1.5**	**1.5**	**1.5**	**1.6**	**1.7**	**1.7**	G3-PCX [26]
simple GA	318	127	1956	*11e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	5.0	**2.9**	3.6	3.6	6.1	*42e-3/2e3*	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	5.1	5.6	5.4	5.1	5.1	5.5	5.5	5.7	5.9	6.1	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.2	**2.1**	**1.7**	**1.4**	**1.3**	**1.3**	**1.3**	**1.4**	**1.5**	**1.5**	IPOP-SEP-CMA-ES [29]
LSfminbnd	9.0	31	158	564	825	684	*72e-1/1e4*	.	.	.	LSfminbnd [28]
LSstep	137	255	2294	*59e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	11	4.9	7.5	6.6	5.7	5.5	5.1	4.9	4.8	4.4	MA-LS-Chain [21]
MCS	**1.8**	33	*42e+0/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**2.2**	**2.4**	**2.7**	**2.4**	**2.3**	**2.5**	**2.5**	**2.6**	**3.0**	5.4	NELDER (Han) [16]
NELDER (Doe)	**1.5**	**2.3**	9.1	15	20	46	79	317	*46e-5/2e4*	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1.1**	**1.1**	**1.2**	**1.3**	**1.3**	NEWUOA [31]
(1+1)-ES	**2.0**	**2.2**	**2.1**	**2.0**	**2.8**	3.7	4.3	4.8	4.7	4.9	(1+1)-ES [1]
POEMS	89	26	31	27	26	26	25	26	27	27	POEMS [20]
PSO	6.4	283	1082	1009	705	586	502	460	423	577	PSO [7]
PSO_Bounds	9.5	45	117	109	104	102	96	96	115	163	PSO_Bounds [8]
Monte Carlo	2.42e5	*48e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.1**	3.9	31	56	150	163	572	*21e-2/1e4*	.	.	Rosenbrock [27]
VNS (Garcia)	5.0	**2.8**	**1.9**	**1.4**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	VNS (Garcia) [11]

Table 103: Running time excess ERT/ERT$_{\text{best}}$ on f_7 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.53	7.6	68	214	475	826	826	826	826	848	ERT$_{\text{best}}$/D
ALPS-GA	5.0	26	30	849	934	*48e-2/2e5*	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**3.0**	10	3.6	**2.1**	**1.3**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
BayEDAcG	4.3	31	57	*11e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.5**	**2.8**	**1**	4.9	3.5	**2.2**	**2.2**	**2.2**	**2.2**	**2.1**	BIPOP-CMA-ES [15]
BFGS	69	*67e+1/100*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	129	134	44	29	18	14	14	14	14	14	Cauchy EDA [24]
(1+1)-CMA-ES	**1.6**	16	30	54	304	*92e-2/1e4*	.	.	.	.	(1+1)-CMA-ES [2]
DASA	16	49	17834	*13e+0/4e5*	.	.	.	.	.	.	DASA [19]
DEPSO	**2.7**	7.9	18	*77e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	3.5	7.0	*15e+0/6e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**2.5**	65	26	952	*15e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	14	**1.9**	4.6	700	*27e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	4.7	**2.8**	765	*12e+0/1e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	5.8	176	77	*32e-1/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	4.6	**2.9**	*22e+0/700*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**2.0**	5.8	**1.7**	**1**	**1**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.4	**2.8**	**2.3**	**4.0**	**2.4**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	IPOP-SEP-CMA-ES [29]
LSfminbnd	23	21	1045	*15e+0/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	232	184	2184	*29e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	3.4	5.4	4.3	119	358	385	387	387	387	376	MA-LS-Chain [21]
MCS	**1**	57	*38e+0/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	4.5	4.6	2160	*16e+0/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**2.5**	**1**	370	*97e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	3.6	43	*18e+0/2e4*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	3.1	1076	*27e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	443	55	21	1996	3055	*12e-1/1e5*	.	.	.	.	POEMS [20]
PSO	**2.5**	4.8	427	*62e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	3.3	26	9654	*22e+0/1e5*	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	3.2	2.07e5	*10e+1/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	496	*38e+1/3e3*	.	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1.1**	3.7	5.4	78	72	2395	2395	2395	2395	2332	VNS (Garcia) [11]

Table 104: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_8 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	5.5	21	102	194	202	207	211	215	219	224	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	70	51	98	443	602	742	1024	1246	3133	*26e-6/2e5*	ALPS-GA [17]
AMaLGaM IDEA	25	16	19	18	19	20	20	21	21	22	AMaLGaM IDEA [4]
BayEDAcG	55	35	*48e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.0	**2.4**	4.0	4.0	4.3	4.5	4.5	4.6	4.6	4.6	BIPOP-CMA-ES [15]
BFGS	**1.9**	**2.0**	**1.8**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	BFGS [30]
Cauchy EDA	356	200	191	178	209	255	263	291	357	543	Cauchy EDA [24]
(1+1)-CMA-ES	**2.7**	**1.8**	3.7	6.3	6.6	6.6	6.6	6.7	6.6	6.6	(1+1)-CMA-ES [2]
DASA	15	26	33	55	121	198	277	351	420	549	DASA [19]
DEPSO	16	16	*17e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	25	82	*64e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	219	110	187	211	264	332	408	*17e-5/1e5*	.	.	EDA-PSO [6]
full NEWUOA	3.4	**2.6**	**1.4**	**1.6**	**1.6**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	full NEWUOA [31]
G3-PCX	3.9	**2.0**	**2.6**	5.4	5.5	5.5	5.5	5.5	5.5	5.6	G3-PCX [26]
simple GA	478	253	*17e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	4.1	**2.4**	**1.6**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**	GLOBAL [23]
iAMaLGaM IDEA	13	6.4	8.3	8.9	10	10	10	10	10	11	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.5	**1.7**	5.4	5.4	5.7	5.7	5.8	5.8	5.8	5.8	IPOP-SEP-CMA-ES [29]
LSfminbnd	7.1	17	9.2	114	707	719	*40e-1/1e4*	.	.	.	LSfminbnd [28]
LSstep	151	71	24	124	222	347	*12e-1/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	12	10	13	12	13	13	14	13	13	13	MA-LS-Chain [21]
MCS	**1.4**	**1.2**	**1.5**	**1.7**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	**1.8**	MCS [18]
NELDER (Han)	3.2	**2.9**	3.3	3.8	4.1	4.5	4.9	5.1	5.3	5.6	NELDER (Han) [16]
NELDER (Doe)	3.2	**3.0**	**2.8**	4.7	5.5	6.0	6.5	7.2	7.7	9.1	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**2.5**	11	13	117	124	138	157	177	196	234	(1+1)-ES [1]
POEMS	104	84	571	7397	*74e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	15	19	90	307	350	406	466	579	894	3277	PSO [7]
PSO_Bounds	88	158	524	432	1795	7172	*15e-2/1e5*	.	.	.	PSO_Bounds [8]
Monte Carlo	*80e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.0**	**1.1**	3.8	24	28	35	42	55	62	666	Rosenbrock [27]
VNS (Garcia)	6.0	3.1	5.8	6.0	6.3	6.4	6.4	6.4	6.4	6.4	VNS (Garcia) [11]

Table 105: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_9 in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	18	86	155	164	169	173	176	180	186	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	4800	37	349	*48e-1/2e5*	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	1962	11	22	22	23	24	24	25	25	25	AMaLGaM IDEA [4]
BayEDAcG	4764	27	*18e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	394	**2.6**	4.7	5.7	6.0	6.1	6.1	6.1	6.1	6.1	BIPOP-CMA-ES [15]
BFGS	207	**1.9**	**2.2**	**2.2**	**2.1**	**2.1**	**2.0**	**2.0**	**2.0**	**1.9**	BFGS [30]
Cauchy EDA	32665	221	193	270	290	303	309	342	473	630	Cauchy EDA [24]
(1+1)-CMA-ES	256	**2.4**	4.5	6.7	7.0	7.0	7.0	7.0	7.0	6.9	(1+1)-CMA-ES [2]
DASA	1978	77	207	1337	1492	1770	2072	2406	2706	3734	DASA [19]
DEPSO	1382	25	*18e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	4.7	*22e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	21911	127	284	450	*14e-2/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	462	**3.0**	**1.8**	**2.2**	**2.3**	**2.3**	**2.3**	**2.3**	**2.3**	**2.2**	full NEWUOA [31]
G3-PCX	413	3.6	**2.9**	3.8	4.0	4.1	4.1	4.1	4.1	4.2	G3-PCX [26]
simple GA	43730	273	*19e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	416	**2.0**	**1.7**	**1.7**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.5**	GLOBAL [23]
iAMaLGaM IDEA	1419	7.5	10	11	12	12	12	12	12	13	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	325	**2.2**	6.9	7.0	7.2	7.3	7.3	7.3	7.2	7.2	IPOP-SEP-CMA-ES [29]
LSfminbnd	740	6.5	52	467	*32e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	15338	131	*18e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	824	7.3	17	25	27	29	31	31	30	30	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1.3**	**1.5**	**1.6**	**1.6**	**1.7**	**1.7**	**1.6**	MCS [18]
NELDER (Han)	202	**2.3**	3.6	6.6	7.2	7.8	8.4	8.6	8.8	8.9	NELDER (Han) [16]
NELDER (Doe)	154	**1.4**	3.3	6.1	6.6	7.0	7.5	7.9	8.4	9.4	NELDER (Doe) [5]
NEWUOA	**132**	**1.3**	**1.0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	255	**2.2**	12	52	65	86	110	134	159	205	(1+1)-ES [1]
POEMS	10123	74	2033	*99e-1/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	1570	40	671	*75e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	81581	650	705	9662	*20e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*68e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	192	**1.2**	8.4	31	37	49	63	847	*35e-5/1e4*	.	Rosenbrock [27]
VNS (Garcia)	513	3.2	6.9	8.2	8.7	8.7	8.7	8.6	8.6	8.5	VNS (Garcia) [11]

Table 106: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{10} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	116	263	371	433	537	682	746	810	854	874	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	266	2525	*16e+1/2e5*	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	3.1	**1.9**	**1.8**	**2.0**	**1.9**	**1.7**	**1.7**	**1.8**	**1.8**	**2.1**	AMaLGaM IDEA [4]
BayEDAcG	*42e+3/2e3*	.	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.5**	**1.9**	**1.9**	**1.8**	**1.6**	**1.3**	**1.2**	**1.1**	**1.1**	**1.1**	BIPOP-CMA-ES [15]
BFGS	**1.3**	**1**	**1.0**	**1**	**1**	**1.1**	**1.1**	**1.3**	3.1	*77e-8/5e4*	BFGS [30]
Cauchy EDA	29	21	20	22	20	19	20	21	21	25	Cauchy EDA [24]
(1+1)-CMA-ES	**2.1**	**1.7**	**1.7**	**1.7**	**1.4**	**1.2**	**1.1**	**1.0**	**1**	**1**	(1+1)-CMA-ES [2]
DASA	319	1187	3360	*72e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	*17e+3/2e3*	.	.	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	*94e+2/5e3*	.	.	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	386	*36e+1/1e5*	.	.	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	8.1	15	34	*67e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**2.5**	3.4	6.5	10	12	13	15	16	18	23	G3-PCX [26]
simple GA	*15e+3/1e5*	.	.	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1.4**	**1.0**	**1**	**1.1**	**1.1**	**1.2**	**2.0**	**2.6**	5.9	*19e-6/2e3*	GLOBAL [23]
iAMaLGaM IDEA	**1.8**	**1.3**	**1.3**	**1.3**	**1.2**	**1**	**1**	**1**	**1.0**	**1.1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	5.8	3.8	3.1	**2.9**	**2.4**	**2.0**	**1.8**	**1.7**	**1.6**	**1.6**	IPOP-SEP-CMA-ES [29]
LSfminbnd	234	*22e+2/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	*18e+3/1e4*	.	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	9.0	12	11	13	11	8.5	7.8	7.2	6.9	6.8	MA-LS-Chain [21]
MCS	*72e+2/4e3*	.	.	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**2.3**	5.3	390	*30e+0/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.8**	4.2	30	*57e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	**1.7**	**2.6**	3.3	3.3	4.0	4.3	4.7	5.8	NEWUOA [31]
(1+1)-ES	41	111	301	696	996	1043	2234	3495	8686	*94e-5/1e6*	(1+1)-ES [1]
POEMS	4178	*12e+2/1e5*	.	.	.	.	.	.	.	.	POEMS [20]
PSO	958	5622	*84e+1/1e5*	.	.	.	.	.	.	.	PSO [7]
PSO_Bounds	528	*41e+1/1e5*	.	.	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*11e+4/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	22	136	*27e+1/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	6.7	5.7	4.8	4.7	4.2	3.4	3.1	**2.9**	**2.8**	**2.7**	VNS (Garcia) [11]

Table 107: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.4	24	50	111	314	429	488	554	614	742	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	5.0	59	494	977	2237	*12e-2/2e5*	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	7.0	**3.3**	5.0	3.7	**1.9**	**1.6**	**1.7**	**1.8**	**1.8**	**1.9**	AMaLGaM IDEA [4]
BayEDAcG	4.9	252	*14e+1/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.1	18	10	5.1	**1.9**	**1.5**	**1.4**	**1.3**	**1.2**	**1.0**	BIPOP-CMA-ES [15]
BFGS	**2.9**	**1**	**1**	**1**	**1.3**	**2.6**	147	*31e-4/1e4*	.	.	BFGS [30]
Cauchy EDA	103	71	64	44	22	20	22	24	25	26	Cauchy EDA [24]
(1+1)-CMA-ES	**2.4**	5.6	7.0	5.1	**2.4**	**2.3**	**2.4**	**2.4**	**2.3**	**2.0**	(1+1)-CMA-ES [2]
DASA	4.4	115	569	692	420	548	725	807	978	1529	DASA [19]
DEPSO	8.2	106	*95e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**2.1**	23	*76e+0/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	4.3	74	1873	13123	*79e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	5.0	40	57	45	21	18	36	88	*75e-5/1e4*	.	full NEWUOA [31]
G3-PCX	4.0	10	18	14	7.0	6.5	7.1	7.3	7.6	8.0	G3-PCX [26]
simple GA	4.2	121	29308	*20e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	5.0	**1.5**	**1.2**	**1.0**	**1**	**2.2**	*74e-4/1e3*	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	4.4	5.2	**4.4**	**2.7**	**1.2**	**1**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.1	34	20	10	3.7	**2.8**	**2.5**	**2.3**	**2.1**	**1.8**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.0**	*22e+1/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**2.4**	*29e+1/1e4*	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**2.6**	30	63	35	14	12	11	10	9.3	7.8	MA-LS-Chain [21]
MCS	**1**	53	*62e+0/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	3.3	5.2	41	292	*16e-1/1e4*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	4.4	4.4	17	24	74	*75e-3/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1.5**	15	15	13	5.8	5.6	6.1	6.2	6.6	6.5	NEWUOA [31]
(1+1)-ES	2074	1366	1625	1233	575	559	606	615	665	684	(1+1)-ES [1]
POEMS	129	52	443	407	190	195	981	*34e-4/1e5*	.	.	POEMS [20]
PSO	4.1	46	143	186	109	114	132	141	148	2019	PSO [7]
PSO_Bounds	4.4	208	575	438	222	244	478	658	1205	*12e-4/1e5*	PSO_Bounds [8]
Monte Carlo	5.5	929	*67e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.9**	883	*11e+1/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	44	23	12	6.2	**2.4**	**1.9**	**1.8**	**1.6**	**1.6**	**1.4**	VNS (Garcia) [11]

Table 108: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{12} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	25	30	52	97	137	158	207	321	620	691	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	80	90	87	244	839	3528	*33e-3/2e5*	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	28	29	19	12	13	16	15	12	7.6	8.4	AMaLGaM IDEA [4]
BayEDAcG	55	60	42	77	*21e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**3.0**	3.0	3.0	4.0	4.5	4.9	4.5	3.3	**1.9**	**2.0**	BIPOP-CMA-ES [15]
BFGS	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.7**	**1.6**	**2.2**	**1.8**	45	BFGS [30]
Cauchy EDA	448	515	507	445	418	402	382	358	392	1084	Cauchy EDA [24]
(1+1)-CMA-ES	**1.8**	3.1	7.7	10	10	10	8.3	6.0	3.4	3.6	(1+1)-CMA-ES [2]
DASA	13	16	21955	28391	47454	88736	67634	43560	22569	*13e+0/1e6*	DASA [19]
DEPSO	39	48	68	*77e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	338	325	421	235	*25e+3/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	234	246	302	261	721	2616	6828	4403	2285	*57e-3/1e5*	EDA-PSO [6]
full NEWUOA	**2.3**	6.7	11	15	26	27	38	37	35	105	full NEWUOA [31]
G3-PCX	**2.4**	**2.5**	**2.7**	**2.8**	**3.0**	3.3	**2.9**	**2.1**	**1.2**	**1.3**	G3-PCX [26]
simple GA	7093	14791	*14e+2/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1.1**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.1**	3.4	GLOBAL [23]
iAMaLGaM IDEA	12	13	8.7	6.6	7.2	8.1	7.8	6.0	3.6	3.9	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.7**	**2.8**	5.8	6.7	6.4	6.8	5.9	4.3	**2.4**	**2.5**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.9**	3.0	97	414	*76e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	29	35	228	676	*16e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	11	12	7.4	10	131	139	150	97	51	47	MA-LS-Chain [21]
MCS	**1.3**	**1.3**	**1.1**	8.4	12	24	43	87	94	*16e-4/4e3*	MCS [18]
NELDER (Han)	**2.7**	5.5	19	26	57	78	338	458	*54e-4/1e4*	.	NELDER (Han) [16]
NELDER (Doe)	**2.3**	4.1	13	45	61	396	1393	*21e-3/2e4*	.	.	NELDER (Doe) [5]
NEWUOA	**1.3**	**1.3**	**3.0**	3.0	3.0	**3.0**	**2.5**	**1.8**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1.7**	**1.7**	12303	67094	*52e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	157	169	417	2137	*37e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	636	550	1704	*64e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	238	265	700	3004	5068	*64e-1/1e5*	.	.	.	.	PSO_Bounds [8]
Monte Carlo	*28e+6/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	14	56	208	913	*70e-2/1e4*	.	.	.	Rosenbrock [27]
VNS (Garcia)	3.3	3.4	5.9	5.9	6.6	9.1	8.3	7.4	4.1	4.4	VNS (Garcia) [11]

Table 109: Running time excess ERT/ERT_{best} on f_{13} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	3.2	8.5	33	101	138	175	937	1086	1223	1510	ERT_{best}/D
ALPS-GA	49	130	97	127	420	2682	*14e-3/2e5*	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	18	41	18	8.0	8.0	7.7	**1.7**	**1.7**	**1.7**	**1.7**	AMaLGaM IDEA [4]
BayEDAcG	45	152	908	*49e+0/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.6	5.1	4.3	**2.7**	5.1	6.2	**1.5**	**1.6**	**2.3**	3.0	BIPOP-CMA-ES [15]
BFGS	**1.2**	**1.6**	**1.7**	**1**	**1**	**1**	23	87	*96e-5/2e4*	.	BFGS [30]
Cauchy EDA	262	411	214	105	102	101	23	23	23	23	Cauchy EDA [24]
(1+1)-CMA-ES	**2.9**	3.4	4.9	7.1	10	11	4.2	5.7	6.3	14	(1+1)-CMA-ES [2]
DASA	15	22	385	232	574	1563	668	1195	3729	*51e-6/1e6*	DASA [19]
DEPSO	11	40	64	*53e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	15	2410	*13e+1/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	110	327	162	326	1175	*12e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	4.1	3.6	**1.8**	6.0	18	49	26	40	116	*30e-4/1e4*	full NEWUOA [31]
G3-PCX	4.3	4.8	9.3	17	43	75	47	106	126	326	G3-PCX [26]
simple GA	291	701	5116	*10e+0/1e5*	.	.	.	.	.	.	simple GA [22]
GLOBAL	5.7	3.1	**2.0**	**1.1**	**1.1**	**1.1**	4.5	4.2	*16e-4/1e3*	.	GLOBAL [23]
iAMaLGaM IDEA	9.2	18	8.7	4.1	**4.3**	**4.4**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	3.6	5.0	5.8	5.4	7.7	8.0	**1.7**	**1.9**	**1.9**	**2.0**	IPOP-SEP-CMA-ES [29]
LSfminbnd	6.2	8.7	19	19	68	148	156	135	*53e-3/1e4*	.	LSfminbnd [28]
LSstep	175	312	464	1435	*12e+0/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	7.3	22	11	394	704	1846	1528	1320	*27e-3/1e5*	.	MA-LS-Chain [21]
MCS	**1.3**	8.4	34	37	61	331	*60e-2/4e3*	.	.	.	MCS [18]
NELDER (Han)	**2.3**	6.4	11	29	60	185	77	134	*35e-3/1e4*	.	NELDER (Han) [16]
NELDER (Doe)	**1.5**	3.4	12	18	31	87	98	271	*36e-4/2e4*	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	3.0	9.3	37	19	126	*43e-4/9e3*	.	NEWUOA [31]
(1+1)-ES	**2.5**	3.3	7.4	13	26	95	50	113	410	2031	(1+1)-ES [1]
POEMS	105	199	1663	13916	*59e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	6.1	1841	6156	6441	10189	7994	1495	1291	*22e+0/1e5*	.	PSO [7]
PSO_Bounds	12	308	2263	4087	*50e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	1.47e5	*92e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**2.2**	**2.0**	**2.5**	4.2	8.3	31	17	43	122	*18e-4/1e4*	Rosenbrock [27]
VNS (Garcia)	5.8	6.2	4.3	55	121	179	127	325	537	1469	VNS (Garcia) [11]

Table 110: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{14} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	0.05	3.8	12	15	23	47	67	82	783	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	3.7	41	56	78	93	191	1225	*34e-6/2e5*	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	4.7	19	22	30	28	17	15	14	**1.9**	AMaLGaM IDEA [4]
BayEDAcG	**1**	7.2	55	67	152	248	*15e-3/2e3*	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	7.6	3.9	**2.9**	3.7	4.3	4.1	5.0	6.2	**1.2**	BIPOP-CMA-ES [15]
BFGS	**1**	23	**2.7**	**1.8**	**2.0**	**1.8**	**1.2**	**1.1**	**1.1**	*18e-7/1e4*	BFGS [30]
Cauchy EDA	**1**	931	279	265	351	338	211	183	179	25	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	18	3.1	**1.9**	**2.3**	**2.5**	**2.3**	3.4	**5.6**	**1.2**	(1+1)-CMA-ES [2]
DASA	**1**	93	16	10	12	22	75	559	5222	*43e-7/1e6*	DASA [19]
DEPSO	**1**	13	14	14	25	49	*44e-4/2e3*	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	8.4	153	290	*90e-3/5e3*	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	3.8	85	137	200	194	126	346	*21e-6/1e5*	.	EDA-PSO [6]
full NEWUOA	**1**	47	5.9	3.0	3.6	3.3	**2.6**	5.0	20	*12e-7/1e4*	full NEWUOA [31]
G3-PCX	**1**	5.7	4.1	**2.4**	**2.8**	3.0	**2.7**	4.5	13	59	G3-PCX [26]
simple GA	**1**	4.1	277	319	477	2900	*72e-4/1e5*	.	.	.	simple GA [22]
GLOBAL	**1**	7.5	5.0	**2.2**	**2.1**	**1.8**	**1.1**	**1**	**1**	*28e-7/400*	GLOBAL [23]
iAMaLGaM IDEA	**1**	4.3	11	9.3	13	12	7.8	6.9	6.9	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	14	3.3	**2.6**	3.2	3.7	6.8	8.8	10	**1.6**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	83	8.4	5.2	5.6	9.3	57	*31e-5/1e4*	.	.	LSfminbnd [28]
LSstep	**1**	908	186	115	118	208	*46e-4/1e4*	.	.	.	LSstep [28]
MA-LS-Chain	**1**	4.1	7.6	11	13	16	14	23	23	6.0	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**2.1**	3.4	3.7	3.2	*15e-5/4e3*	.	.	MCS [18]
NELDER (Han)	**1**	23	**2.3**	**3.0**	3.9	3.6	**2.9**	4.9	36	*44e-7/1e4*	NELDER (Han) [16]
NELDER (Doe)	**1**	11	**2.0**	**2.1**	3.5	3.7	3.0	5.4	21	*26e-7/2e4*	NELDER (Doe) [5]
NEWUOA	**1**	20	**1.5**	**1**	**1**	**1**	**1**	**2.3**	9.1	43	NEWUOA [31]
(1+1)-ES	**1**	17	**2.5**	**1.8**	**2.0**	**2.2**	4.8	38	466	*71e-8/1e6*	(1+1)-ES [1]
POEMS	**1**	3066	107	66	121	164	130	1950	*94e-6/1e5*	.	POEMS [20]
PSO	**1**	7.2	6.7	12	20	27	54	576	*44e-6/1e5*	.	PSO [7]
PSO_Bounds	**1**	4.6	23	103	173	238	378	1307	*78e-6/1e5*	.	PSO_Bounds [8]
Monte Carlo	**1**	5.3	45205	*80e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	80	**2.4**	**1.2**	**1.3**	**1.8**	7.4	97	*71e-6/1e4*	.	Rosenbrock [27]
VNS (Garcia)	**1**	**3.6**	6.4	3.9	4.4	5.1	5.0	6.4	7.8	**1.4**	VNS (Garcia) [11]

Table 111: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{15} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.06	84	1519	7327	15577	15779	15996	16135	22471	22954	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	18	10	*20e+0/2e5*	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	12	7.1	**1.5**	**2.0**	**1.7**	**1.7**	**1.7**	**1.7**	**1.2**	**1.2**	AMaLGaM IDEA [4]
BayEDAcG	13	23	*93e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	17	**1.2**	**1**	**2.0**	**1.4**	**1.4**	**1.4**	**1.4**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	667	*25e+1/6e3*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	1654	68	*67e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	33	73	*85e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	156	29854	*11e+1/1e6*	.	.	.	.	.	.	.	DASA [19]
DEPSO	12	*12e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	109	*10e+1/5e3*	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	20	22	36	*80e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	121	81	*77e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	21	548	*92e+0/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	21	59	*25e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	13	*25e+1/1e3*	.	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	12	3.1	**2.8**	14	7.5	7.5	7.4	7.4	5.3	**5.2**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	14	**1**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1.1**	6.4	IPOP-SEP-CMA-ES [29]
LSfminbnd	131	*14e+1/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	2403	*22e+1/1e4*	.	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**10**	3.7	6.9	*60e-1/1e5*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	70	*10e+1/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	28	54	*80e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	25	17	*54e+0/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	29	1078	*12e+1/6e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	340	5350	*82e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	2699	23	*34e+0/1e5*	.	.	.	.	.	.	.	POEMS [20]
PSO	16	92	*49e+0/1e5*	.	.	.	.	.	.	.	PSO [7]
PSO_Bounds	14	224	*51e+0/1e5*	.	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	16	*26e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	7695	*35e+1/1e4*	.	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	22	**1.5**	309	*60e-1/6e6*	.	.	.	.	.	.	VNS (Garcia) [11]

Table 112: Running time excess ERT/ERT$_{\text{best}}$ on f_{16} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.05	0.05	69	1363	3851	6963	9397	9762	9889	11005	ERT$_{\text{best}}$/D
ALPS-GA	**1**	**1.2**	9.3	114	*78e-2/2e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	14	3.3	**5.2**	**5.4**	**6.2**	**6.1**	**6.1**	**5.7**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.2**	*21e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.3**	**1.7**	**1.0**	**1.2**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	141	*26e+0/2e4*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	3.5	*16e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.1**	34	*53e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**2.3**	976	*44e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	*23e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	8.3	7.0	*12e-1/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.3**	527	55	384	*75e-2/1e5*	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.9**	4.6	108	*25e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.3**	17	*32e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.3**	138	1037	*24e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.2**	**1**	*42e-1/600*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.2**	3.6	**1.7**	13	18	29	29	28	26	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.2**	**3.1**	**1**	**1**	**1.1**	**1.4**	**1.9**	**1.9**	**1.7**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1.1**	160	*95e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	239	*10e+0/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	19	*18e-1/1e5*	.	.	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	11	*75e-1/4e3*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1.3**	17	*47e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1.4**	7.2	*30e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	16	*53e-1/1e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.2**	1398	*72e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	252	15	21	105	*58e-2/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1.3**	111	*47e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.2**	128	1036	*25e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.3**	65226	*11e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	3.4	*29e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	3.6	9.1	502	*72e-3/3e6*	.	.	.	.	VNS (Garcia) [11]

Table 113: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{17} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	0.05	3.1	52	200	612	1534	2231	2814	4024	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.5**	19	28	5062	*16e-2/2e5*	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	14	7.7	4.3	5.1	**4.7**	**3.5**	**5.1**	**5.4**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**2.0**	19	19	48	*15e-2/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	4.0	**2.2**	**1**	**1**	**1**	**1.2**	**1.4**	**1.3**	**1.4**	BIPOP-CMA-ES [15]
BFGS	**1**	352	359	*56e-1/2e4*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.1**	203	256	125	62	30	16	16	23	*37e-7/5e4*	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1.9**	29	*49e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	8.5	65812	*57e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.5**	8.3	18	147	*43e-2/2e3*	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1.8**	55	*55e-2/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.3**	13	36	20	22	10	8.1	18	21	EDA-PSO [6]
full NEWUOA	**1**	9.4	13	*37e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.2**	4.0	*35e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.2**	57	92	7070	*21e-2/1e5*	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1.6**	6.2	*44e-1/3e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.5**	6.4	**2.9**	**1.5**	**1.4**	6.1	22	29	23	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.4**	**2.8**	4.0	3.1	**1.6**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	6.8	992	*82e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	55	1698	*78e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.3**	3.5	5.1	7.7	10	12	33	59	86	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	*42e-1/4e3*	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1.3**	237	*62e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	4.0	**2.1**	*46e-1/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	5.1	16	*38e-1/8e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	5.7	52249	*73e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	541	94	25	19	198	267	*11e-3/1e5*	.	.	POEMS [20]
PSO	**1**	**1.1**	3.2	2502	*10e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.3**	**3.0**	831	*85e-2/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	120	*50e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	16020	20701	*19e+0/1e4*	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.2**	5.3	**1.2**	**1.5**	5.8	34	2500	*10e-5/4e6*	.	VNS (Garcia) [11]

Table 114: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{18} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	0.14	31	199	978	1428	3378	4977	6530	7326	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1.1**	3.8	15	430	*69e-2/2e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1.2**	3.8	7.3	3.0	**1**	**1**	**1.7**	**2.7**	**2.8**	**3.7**	AMaLGaM IDEA [4]
BayEDAcG	**1**	6.4	15	17	*95e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	5.3	**1.0**	**2.4**	**1.2**	**1.6**	**1.1**	**1.8**	**1.7**	**1.6**	BIPOP-CMA-ES [15]
BFGS	**1**	915	*21e+0/2e4*	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**2.5**	270	96	42	15	16	12	13	38	*25e-6/5e4*	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	12	4824	*16e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	60	4.55e5	*25e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	7.9	7.1	49	*16e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	6.5	9.1	113	*12e-1/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.1**	4.2	30	15	5.2	5.4	18	83	217	*47e-5/1e5*	EDA-PSO [6]
full NEWUOA	**1.1**	23	948	*12e+0/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.1**	**2.2**	7104	*14e+0/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	7.8	76	311	*73e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1.1**	5.9	*17e+0/4e3*	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.2**	3.4	**2.7**	**1.2**	**2.3**	3.7	19	18	16	18	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	8.5	**1**	**1.0**	**1.1**	**1.2**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
LSfminbnd	**2.2**	31	4518	*26e+0/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1.1**	613	*31e+0/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	5.8	3.6	3.6	26	78	210	*43e-4/1e5*	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	*17e+0/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	828	*20e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	6.5	4323	*14e+0/2e4*	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	3.9	320	11930	*11e+0/8e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	2.94e5	*24e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	5.1	1125	21	144	210	986	*38e-2/1e5*	.	.	.	POEMS [20]
PSO	**1.1**	5.2	236	*29e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1.1**	**2.4**	69	7091	*22e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1.1**	7.7	*18e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	14287	48116	*97e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**2.5**	**1.3**	**1**	14	255	*40e-4/4e6*	.	.	.	VNS (Garcia) [11]

Table 115: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{19} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	0.05	0.05	0.05	17160	2.34e5	3.11e5	3.33e5	3.34e5	3.37e5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	1248	6.18e5	*31e-2/2e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.2**	736	33911	**7.6**	**4.5**	**8.8**	**8.2**	**8.2**	**8.1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	1522	*41e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	169	**23770**	**1.2**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	166	1.15e6	*12e+0/1e4*	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	3.4	8407	*34e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	1365	2.82e6	*18e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**2.1**	1.79e6	*58e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.1**	430	*50e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	**1**	**1**	*21e-2/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1.1**	4640	2.85e7	*26e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1.3**	475	*21e-1/1e4*	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1.1**	796	*26e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1.1**	13614	6.53e5	*44e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	5601	*57e-1/3e3*	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1.1**	456	1.85e6	44	***72e-3/1e6***	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	153	26669	8.7	***29e-2/1e4***	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**2.6**	1173	*38e-1/1e4*	.	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	127	7789	*41e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1.1**	275	29410	13	***11e-2/1e5***	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	**1**	**1**	**1**	***25e-2/4e3***	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1**	165	1.45e6	*19e-1/1e4*	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**73**	4.28e5	*96e-2/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1.1**	76	4.29e6	*12e-1/1e5*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**2.5**	6.28e6	*56e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	168	6196	1.36e6	*94e-2/1e5*	.	.	.	.	.	POEMS [20]
PSO	**1**	**1.1**	382	*32e-1/1e5*	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1.1**	819	*31e-1/1e5*	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1.1**	5.88e5	*78e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	30776	*33e+0/1e4*	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	326	82240	*21e-2/6e6*	.	.	.	.	.	VNS (Garcia) [11]

Table 116: Running time excess ERT/ERT_{best} on f_{20} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT_{best}/D	2.8	3.5	4.1	2307	1.55e5	2.76e5	2.77e5	2.78e5	2.80e5	2.82e5	ERT_{best}/D
ALPS-GA	48	54	53	9.2	*47e-2/2e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	20	22	20	88	*68e-2/1e6*	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	47	51	49	*31e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.7	4.4	4.3	9.2	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1.7**	**1.9**	**2.1**	5.8	*90e-2/2e4*	.	.	.	.	.	BFGS [30]
Cauchy EDA	312	326	336	*27e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	3.5	3.6	3.4	21	*11e-1/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	22	21	20	**2.1**	*40e-2/1e6*	.	.	.	.	.	DASA [19]
DEPSO	15	16	15	*21e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	17	36	31	*18e-1/5e3*	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	215	229	230	15	*63e-2/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	4.2	3.4	3.1	64	*12e-1/1e4*	.	.	.	.	.	full NEWUOA [31]
G3-PCX	5.6	5.4	5.0	*12e-1/5e4*	.	.	.	.	.	.	G3-PCX [26]
simple GA	465	517	503	**2.8**	*32e-2/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	6.6	5.6	5.2	**1.6**	*99e-2/4e3*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	14	14	14	243	*88e-2/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.4	4.7	4.5	13	*11e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	11	11	11	5.9	*97e-2/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	231	263	280	11	*10e-1/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	8.0	10	9.4	3.3	**4.8**	*24e-2/1e5*	.	.	.	.	MA-LS-Chain [21]
MCS	5.9	5.4	4.7	12	*12e-1/4e3*	.	.	.	.	.	MCS [18]
NELDER (Han)	3.1	3.4	3.5	*13e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1.9**	**2.1**	**2.2**	28	*11e-1/2e4*	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	15	*10e-1/2e4*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	3.4	3.2	3.1	113	*88e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	130	124	117	**1**	*30e-2/1e5*	.	.	.	.	.	POEMS [20]
PSO	12	15	17	50	*11e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	66	79	86	11	*53e-2/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	1.66e6	*15e+2/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	3.0	**2.7**	**2.6**	**2.9**	*97e-2/1e4*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	8.1	7.7	7.1	**1.1**	*30e-2/1e7*	.	.	.	.	.	VNS (Garcia) [11]

Table 117: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{21} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	0.05	28	327	705	716	732	754	778	879	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	14	13	7.0	7.7	8.3	9.2	10	11	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	51	2413	1549	1529	1499	1460	1418	1261	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	55	*60e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	3.2	55	48	47	46	45	43	39	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	**1.9**	5.5	4.6	4.6	4.5	4.4	4.3	7.3	BFGS [30]
Cauchy EDA	**1**	**1**	1007	*32e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	3.6	7.6	5.8	5.7	5.6	5.4	5.3	4.7	(1+1)-CMA-ES [2]
DASA	**1**	**1**	241	101	103	101	99	96	93	83	DASA [19]
DEPSO	**1**	**1**	22	13	8.3	8.6	8.9	9.3	19	*20e-1/2e3*	DEPSO [12]
DIRECT	**1**	**1**	3.3	27	*19e-1/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	35	846	570	562	550	535	519	461	EDA-PSO [6]
full NEWUOA	**1**	**1**	7.4	**3.4**	4.5	4.5	4.4	4.2	4.1	3.7	full NEWUOA [31]
G3-PCX	**1**	**1**	12	7.2	5.1	5.0	4.9	4.8	4.6	4.1	G3-PCX [26]
simple GA	**1**	**1**	90	625	398	397	904	891	*20e-1/1e5*	.	simple GA [22]
GLOBAL	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2.1**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	10	674	540	536	527	516	543	485	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	15	50	58	57	56	54	53	47	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	30	27	20	20	19	19	18	16	LSfminbnd [28]
LSstep	**1**	**1**	124	204	202	200	197	192	187	168	LSstep [28]
MA-LS-Chain	**1**	**1**	141	309	228	225	220	214	207	184	MA-LS-Chain [21]
MCS	**1**	**1**	26	32	26	25	25	24	23	32	MCS [18]
NELDER (Han)	**1**	**1**	7.7	20	24	24	23	23	22	20	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	7.6	4.0	**2.0**	**2.1**	**2.1**	**2.0**	**2.0**	**1.8**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1.7**	**2.2**	**1.2**	**1.2**	**1.2**	**1.1**	**1.1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	8.3	13	9.4	9.3	9.1	8.8	8.6	7.6	(1+1)-ES [1]
POEMS	**1**	**1**	2489	*67e-1/1e5*	.	.	.	.	.	.	POEMS [20]
PSO	**1**	**1**	1784	4281	1986	1956	1913	1857	1799	1593	PSO [7]
PSO_Bounds	**1**	**1**	564	1235	1993	1965	1922	1870	1814	1609	PSO_Bounds [8]
Monte Carlo	**1**	**1**	*26e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	7.8	7.6	4.7	4.6	4.5	4.4	4.3	3.8	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	11	55	29	29	29	28	27	25	VNS (Garcia) [11]

Table 118: Running time excess ERT/ERT$_{\text{best}}$ on f_{22} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
ERT$_{\text{best}}$/D	0.05	0.05	23	279	1175	1208	1247	1307	1342	6740	ERT$_{\text{best}}$/D
ALPS-GA	**1**	**1**	19	10	79	81	86	113	184	133	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	8.2	1889	*69e-2/1e6*	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	34	31	*20e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	6.8	13	215	209	202	193	188	37	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	**2.5**	**1.8**	8.1	7.9	7.7	7.4	10	14	BFGS [30]
Cauchy EDA	**1.1**	**1.1**	470	1186	*51e-1/5e4*	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	3.5	**4.2**	**5.6**	**5.5**	**5.3**	**5.1**	**5.0**	**1**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	34	75	218	214	209	201	198	40	DASA [19]
DEPSO	**1**	**1**	20	16	*26e-1/2e3*	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	10	16	*71e-2/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	1599	995	*26e-1/1e5*	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	**2.2**	12	60	59	57	54	53	11	full NEWUOA [31]
G3-PCX	**1**	**1**	11	6.6	23	22	22	21	20	4.0	G3-PCX [26]
simple GA	**1**	**1**	110	1452	*20e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1.3**	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	8.1	437	*69e-2/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	6.2	23	*69e-2/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	59	16	37	36	36	35	34	7.2	LSfminbnd [28]
LSstep	**1**	**1**	280	*51e-1/1e4*	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	3.8	812	*20e-1/1e5*	.	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	17	20	50	48	47	*20e-1/4e3*	.	.	MCS [18]
NELDER (Han)	**1**	**1**	17	18	61	59	58	55	54	11	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	5.2	6.5	8.3	8.2	8.0	7.7	7.5	**1.5**	NELDER (Doe) [5]
NEWUOA	**1**	**1**	**1**	4.9	**6.8**	**6.6**	**6.4**	**6.2**	**6.0**	**1.2**	NEWUOA [31]
(1+1)-ES	**1**	**1**	11	5.0	11	11	11	10	10	**2.1**	(1+1)-ES [1]
POEMS	**1**	**1**	2267	5022	*51e-1/1e5*	.	.	.	.	.	POEMS [20]
PSO	**1**	**1**	5.0	411	*20e-1/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1**	678	727	1201	1173	1141	1095	1070	215	PSO_Bounds [8]
Monte Carlo	**1**	**1**	6.36e5	*30e+0/1e6*	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	3.4	4.3	12	12	12	11	11	**2.2**	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	14	67	1277	1243	1207	1154	1127	440	VNS (Garcia) [11]

Table 119: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D	1e+03 0.05	1e+02 0.05	1e+01 0.16	1e+00 81	1e-01 3373	1e-02 18276	1e-03 24442	1e-04 25501	1e-05 40551	1e-07 41895	Δftarget $\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	**1.9**	82	*29e-2/2e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.7**	23	**1.1**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.6**	*23e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	4.3	32	**1**	**1.7**	**2.0**	**1.9**	**1.2**	**1.2**	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	47	304	*13e-1/5e3*	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1**	**1**	**1.9**	*19e-1/5e4*	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	**1**	5.8	9.1	*37e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	3.4	64	*31e-2/1e6*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	**1.6**	*26e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	**1**	4.1	52	*38e-2/5e3*	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1**	**1**	**2.1**	*16e-1/1e5*	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	**1**	**1**	14	7.0	44	*25e-2/1e4*	.	.	.	.	full NEWUOA [31]
G3-PCX	**1**	**1**	**2.8**	7.8	*30e-2/3e4*	.	.	.	.	.	G3-PCX [26]
simple GA	**1**	**1**	**1.7**	4570	*12e-1/1e5*	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	**1**	**2.8**	**1**	*43e-2/500*	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1**	**1**	**1.9**	5.4	**1.6**	**2.3**	**5.1**	**5.2**	**3.3**	**3.2**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	4.9	18	3.8	*81e-3/1e4*	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	**1**	**1**	4.4	206	*10e-1/1e4*	.	.	.	.	.	LSfminbnd [28]
LSstep	**1**	**1**	**2.2**	81	*91e-2/1e4*	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1**	**1**	**1.8**	7.1	8.9	*61e-3/1e5*	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	**1**	**1.3**	124	*11e-1/4e3*	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	**1**	**2.1**	**3.3**	43	*20e-2/1e4*	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	**1**	**1.9**	**1.4**	86	*17e-2/2e4*	.	.	.	.	NELDER (Doe) [5]
NEWUOA	**1**	**1**	12	3.5	32	*39e-2/8e3*	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	27	32	*31e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
POEMS	**1**	**1**	23	42	13	*59e-3/1e5*	.	.	.	.	POEMS [20]
PSO	**1**	**1**	**2.2**	1554	*95e-2/1e5*	.	.	.	.	.	PSO [7]
PSO_Bounds	**1**	**1**	**3.0**	8431	*12e-1/1e5*	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	**1**	**2.6**	55404	*11e-1/1e6*	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1**	**1**	**1.7**	4.6	*50e-2/4e3*	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1**	**1**	25	10	1745	*23e-3/2e6*	.	.	.	VNS (Garcia) [11]

Table 120: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{24} in **20-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.05	331	66859	3.74e5	2.60e6	2.60e6	2.60e6	2.60e6	2.60e6	2.60e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	5.7	*22e+0/2e5*	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	4.2	5.1	**19**	***23e-1/1e6***	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	**1**	44	*11e+1/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	5.5	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	8.0	*31e+1/6e3*	.	.	.	.	.	.	.	.	BFGS [30]
Cauchy EDA	**1.7**	76	*91e+0/5e4*	.	.	.	.	.	.	.	Cauchy EDA [24]
(1+1)-CMA-ES	**1**	24	*90e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1.1**	*16e+1/1e6*	.	.	.	.	.	.	.	.	DASA [19]
DEPSO	**1.1**	*14e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
DIRECT	**1**	*15e+1/5e3*	.	.	.	.	.	.	.	.	DIRECT [25]
EDA-PSO	**1.1**	28	*86e+0/1e5*	.	.	.	.	.	.	.	EDA-PSO [6]
full NEWUOA	3.7	4.5	*71e+0/1e4*	.	.	.	.	.	.	.	full NEWUOA [31]
G3-PCX	**1.1**	195	*11e+1/5e4*	.	.	.	.	.	.	.	G3-PCX [26]
simple GA	**1.1**	35	*42e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
GLOBAL	**1**	*21e+1/1e3*	.	.	.	.	.	.	.	.	GLOBAL [23]
iAMaLGaM IDEA	**1.1**	**1.3**	**2.8**	***21e-1/1e6***	.	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1.0**	***23e+0/1e4***	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
LSfminbnd	7.1	*15e+1/1e4*	.	.	.	.	.	.	.	.	LSfminbnd [28]
LSstep	3.1	206	*19e+1/1e4*	.	.	.	.	.	.	.	LSstep [28]
MA-LS-Chain	**1.1**	**2.1**	42	***25e+0/1e5***	.	.	.	.	.	.	MA-LS-Chain [21]
MCS	**1**	12	*10e+1/4e3*	.	.	.	.	.	.	.	MCS [18]
NELDER (Han)	**1**	49	*10e+1/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NELDER (Doe)	**1**	3.7	*50e+0/2e4*	.	.	.	.	.	.	.	NELDER (Doe) [5]
NEWUOA	6.5	4.3	*83e+0/8e3*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	4.1	3116	*93e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
POEMS	**2.7**	10	*46e+0/1e5*	.	.	.	.	.	.	.	POEMS [20]
PSO	**1**	63	*60e+0/1e5*	.	.	.	.	.	.	.	PSO [7]
PSO_Bounds	**1.1**	81	*66e+0/1e5*	.	.	.	.	.	.	.	PSO_Bounds [8]
Monte Carlo	**1**	*26e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]
Rosenbrock	**1.4**	*37e+1/1e4*	.	.	.	.	.	.	.	.	Rosenbrock [27]
VNS (Garcia)	**1**	**1.8**	68	***88e-1/1e7***	.	.	.	.	.	.	VNS (Garcia) [11]

Table 121: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_1 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

1 Sphere

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	46	217	421	639	873	1132	1402	1720	2763	ALPS-GA [17]
AMaLGaM IDEA	**1**	46	154	292	433	565	688	813	968	1230	AMaLGaM IDEA [4]
BayEDAcG	**1**	60	211	351	503	648	794	939	*64e-6/2e3*	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	3.1	10	15	21	28	34	40	45	58	BIPOP-CMA-ES [15]
BFGS	**1**	**1.0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BFGS [30]
(1+1)-CMA-ES	**1**	**3.0**	7.0	11	15	19	23	27	31	39	(1+1)-CMA-ES [2]
DASA	**1**	13	33	57	94	132	179	219	262	344	DASA [19]
DEPSO	**1**	12	65	356	14405	*15e-2/2e3*	.	.	.	.	DEPSO [12]
simple GA	**1**	397	1467	2990	23188	6.83e5	*45e-3/1e5*	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	17	73	127	184	239	294	350	405	516	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	3.0	8.7	14	19	25	30	35	41	51	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	3.9	13	21	28	35	42	49	55	67	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**2.5**	**5.8**	**9.2**	**13**	**16**	**19**	**23**	**26**	**33**	(1+1)-ES [1]
Monte Carlo	**1**	*13e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 122: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_2 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

2 Ellipsoid separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	74	97	118	137	155	172	190	208	221	256	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	14	15	17	19	20	23	26	32	46	143	ALPS-GA [17]
AMaLGaM IDEA	14	14	14	14	14	14	14	14	14	14	AMaLGaM IDEA [4]
BayEDAcG	13	13	13	14	*33e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	7.7	10	11	10	10	9.5	9.0	8.4	8.0	7.1	BIPOP-CMA-ES [15]
BFGS	4.3	5.5	6.0	6.1	5.9	5.6	5.4	5.0	4.8	4.4	BFGS [30]
(1+1)-CMA-ES	6.0	8.1	9.3	9.5	9.5	9.3	8.7	8.2	7.8	6.8	(1+1)-CMA-ES [2]
DASA	**1.7**	**2.1**	**2.5**	**2.8**	**3.0**	**3.3**	**3.4**	**3.5**	**3.7**	**3.8**	DASA [19]
DEPSO	28	311	*65e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	612	2244	*24e+1/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	6.2	7.4	7.7	7.7	7.7	7.6	7.4	7.3	7.4	7.3	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.4**	**1.5**	**1.5**	**1.4**	**1.3**	**1.3**	**1.2**	**1.2**	**1.2**	**1.1**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1.1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NELDER (Han) [16]
NEWUOA	**1**	**2.6**	4.4	6.4	8.8	10	11	12	13	13	NEWUOA [31]
(1+1)-ES	136	634	1461	2454	3412	4412	8873	13896	67815	*93e-5/1e6*	(1+1)-ES [1]
Monte Carlo	*12e+5/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 123: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_3 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

3 Rastrigin separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	5.6	116	440	24564	1.59e5	1.59e5	1.59e5	1.59e5	1.59e5	1.59e5	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	11	32	*16e+0/1e5*	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	13	16	2768	***11e+0/1e6***	.	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	19	*24e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.1**	*12e+0/3e5*	.	.	.	.	.	.	.	BIPOP-CMA-ES [15]
BFGS	114	*64e+1/8e3*	.	.	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	4.1	*33e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	3.5	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	DASA [19]
DEPSO	3.1	*28e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	92	39	**420**	***11e+0/1e5***	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	4.0	4.6	**768**	***90e-1/1e6***	.	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.0**	**1.2**	*16e+0/1e4*	.	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1.9**	*38e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	7.7	*46e+1/7e3*	.	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	303	*42e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	15310	*87e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 124: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_4 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

4 Skew Rastrigin-Bueche separable

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	11	134	574	1.70e6	nan	nan	nan	nan	nan	nan	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	12	66	***26e+0/1e5***	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	24	18	***32e+0/1e6***	.	.	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	27	*25e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.1**	**3.9**	***27e+0/3e5***	.	.	.	.	.	.	.	BIPOP-CMA-ES [15]
BFGS	1190	*97e+1/1e4*	.	.	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	16	*54e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**2.5**	**1**	**1**	**1**	***20e-1/1e6***	.	.	.	.	.	DASA [19]
DEPSO	3.4	*33e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	85	39	**2514**	***17e+0/1e5***	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	6.4	**4.3**	***34e+0/1e6***	.	.	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	5.3	***30e+0/1e4***	.	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	113	*63e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	14	*54e+1/2e4*	.	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	2893	*67e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	6.35e5	*11e+2/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 125: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_5 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

5 Linear slope

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	2.1	2.5	2.9	3.0	3.0	3.0	3.0	3.0	3.0	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	81	137	156	180	199	209	222	226	232	ALPS-GA [17]
AMaLGaM IDEA	**1**	97	122	105	101	100	100	100	100	100	AMaLGaM IDEA [4]
BayEDAcG	**1**	141	213	217	219	218	218	218	218	218	BayEDAcG [10]
BIPOP-CMA-ES	**1**	3.2	4.5	4.5	4.4	4.4	4.4	4.4	4.4	4.4	BIPOP-CMA-ES [15]
BFGS	**1**	**1.4**	**2.1**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	BFGS [30]
(1+1)-CMA-ES	**1**	**1.9**	3.0	**3.0**	**2.9**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	(1+1)-CMA-ES [2]
DASA	**1**	12	17	19	23	27	34	41	50	69	DASA [19]
DEPSO	**1**	18	29	30	30	31	31	31	31	31	DEPSO [12]
simple GA	**1**	1136	2996	4812	7012	9507	12297	15210	18520	*19e-8/1e5*	simple GA [22]
iAMaLGaM IDEA	**1**	5.6	8.1	7.4	7.2	7.1	7.1	7.1	7.1	7.1	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	3.3	5.2	5.4	5.3	5.2	5.3	5.3	5.3	5.3	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	9.1	14	13	13	13	13	13	13	13	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1.8**	**2.9**	**3.0**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	(1+1)-ES [1]
Monte Carlo	**1**	*36e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 126: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_6 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

6 Attractive sector

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.9	46	88	138	179	237	288	332	375	481	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	56	28	53	93	332	*24e-3/1e5*	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	278	67	56	48	47	43	42	41	41	40	AMaLGaM IDEA [4]
BayEDAcG	70	160	*13e+1/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	6.1	**1.9**	**1.6**	**1.5**	**1.5**	**1.4**	**1.4**	**1.4**	**1.4**	**1.4**	BIPOP-CMA-ES [15]
BFGS	**1.9**	3.3	4.2	4.4	4.6	4.5	4.5	4.6	4.9	18	BFGS [30]
(1+1)-CMA-ES	3.6	6.6	356	*12e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	9.0	8.8	18	25	36	41	46	52	56	59	DASA [19]
DEPSO	12	19	*38e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	349	730	*65e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	26	9.4	10	10	11	10	10	11	11	11	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	6.5	**1.9**	**1.9**	**1.8**	**1.9**	**1.8**	**1.8**	**2.0**	**2.0**	**2.0**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	3.3	**2.7**	**2.7**	**2.5**	**2.6**	**2.8**	3.5	5.5	16	68	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**3.1**	**1.9**	3.2	4.6	6.1	6.8	7.4	8.1	8.6	9.0	(1+1)-ES [1]
Monte Carlo	*12e+4/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 127: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_7 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

7 Step-ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.6	31	267	446	1026	1657	1657	1657	1657	1704	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	14	14	1965	*13e+0/1e5*	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	14	12	**2.5**	**2.2**	**1.3**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
BayEDAcG	24	23	*26e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.5**	**1**	**1.2**	8.3	4.0	**2.6**	**2.6**	**2.6**	**2.6**	**2.5**	BIPOP-CMA-ES [15]
BFGS	*20e+2/100*	.	.	.	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	**1.8**	73	100	*12e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	6.0	2206	*76e+0/2e5*	.	.	.	.	.	.	.	DASA [19]
DEPSO	4.9	7.5	*27e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	96	110	*36e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	3.9	**4.0**	**1**	**1**	**1**	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.4**	**1.0**	**2.3**	**5.2**	**2.5**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1.8**	103	*70e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	878	*77e+0/6e4*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	769	*24e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	264	*54e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 128: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_8 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

8 Rosenbrock original

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	15	40	177	266	275	282	286	289	293	299	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	40	84	530	1064	1935	1991	3182	*14e-1/1e5*	.	.	ALPS-GA [17]
AMaLGaM IDEA	27	20	47	40	41	42	43	43	43	44	AMaLGaM IDEA [4]
BayEDAcG	38	50	*87e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.8**	**1.7**	**7.3**	**7.7**	**7.9**	**7.9**	**7.9**	**7.9**	**7.9**	**7.8**	BIPOP-CMA-ES [15]
BFGS	**1.1**	**1.7**	**2.4**	**2.3**	**2.3**	**2.3**	**2.3**	**2.2**	**2.2**	**2.2**	BFGS [30]
(1+1)-CMA-ES	**1.2**	**1**	8.3	8.3	8.6	8.7	8.8	8.8	8.8	8.9	(1+1)-CMA-ES [2]
DASA	6.6	27	55	61	85	116	153	188	224	290	DASA [19]
DEPSO	16	130	*13e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	274	1187	*91e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	11	7.5	17	15	15	15	16	16	16	16	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.6**	**2.0**	10	9.1	9.2	9.1	9.1	9.1	9.1	9.0	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**2.4**	4.0	148	281	550	540	532	526	520	509	NELDER (Han) [16]
NEWUOA	**1**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1.0**	5.5	27	67	73	85	101	117	134	165	(1+1)-ES [1]
Monte Carlo	*87e+3/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 129: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_9 in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

9 Rosenbrock rotated

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	13	35	153	325	333	337	341	345	348	354	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS-GA	21	36	*28e+0/1e5*	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	28	18	54	32	34	35	35	36	36	37	AMaLGaM IDEA [4]
BayEDAcG	38	26	*38e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.8**	**1.5**	**8.2**	**6.2**	**6.4**	**6.5**	**6.5**	**6.5**	**6.5**	**6.5**	BIPOP-CMA-ES [15]
BFGS	**1.1**	**1.4**	**2.7**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	BFGS [30]
(1+1)-CMA-ES	**1.2**	**1.2**	10	10	10	10	10	10	10	10	(1+1)-CMA-ES [2]
DASA	7.7	12	410	423	518	653	817	978	1147	1564	DASA [19]
DEPSO	14	108	*11e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	268	3521	*11e+1/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	13	8.5	20	12	13	13	13	13	13	14	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.6**	**1.2**	10	6.9	7.1	7.1	7.1	7.1	7.1	7.1	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1.6**	**2.3**	160	225	455	449	444	440	*14e+0/1e4*	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1.2**	**1.4**	33	91	95	105	118	131	145	172	(1+1)-ES [1]
Monte Carlo	*83e+3/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 130: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{10} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

10 Ellipsoid

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	165	402	647	759	920	1289	1400	1516	1628	1771	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	*28e+2/1e5*	.	.	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	6.3	3.2	**2.4**	**2.4**	**2.2**	**1.8**	**1.9**	**1.9**	**1.9**	**2.1**	AMaLGaM IDEA [4]
BayEDAcG	*16e+4/2e3*	.	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	3.6	**2.3**	**1.9**	**1.9**	**1.7**	**1.3**	**1.2**	**1.2**	**1.1**	**1.0**	BIPOP-CMA-ES [15]
BFGS	**1.7**	**1.2**	**1**	**1**	**1**	**2.1**	7.8	34	220	*40e-6/1e5*	BFGS [30]
(1+1)-CMA-ES	**2.8**	**2.0**	**1.7**	**1.7**	**1.6**	**1.3**	**1.2**	**1.1**	**1.1**	**1**	(1+1)-CMA-ES [2]
DASA	295	1005	22931	*23e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	*14e+4/2e3*	.	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	*83e+3/1e5*	.	.	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**2.9**	**1.9**	**1.4**	**1.4**	**1.3**	**1**	**1**	**1**	**1**	**1.1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	6.2	3.8	**2.9**	**2.7**	**2.4**	**1.8**	**1.7**	**1.5**	**1.5**	**1.4**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	5.9	*35e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1.2**	**1.6**	**1.8**	**1.5**	**1.7**	**1.8**	**1.9**	**2.1**	NEWUOA [31]
(1+1)-ES	46	127	258	426	577	624	1033	1576	*33e-5/1e6*	.	(1+1)-ES [1]
Monte Carlo	*13e+5/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 131: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{11} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

11 Discus

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	1.8	23	59	121	292	633	744	858	974	1205	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**2.7**	238	965	*33e-1/1e5*	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**2.6**	11	9.5	6.8	3.8	**2.2**	**2.2**	**2.2**	**2.3**	**2.2**	AMaLGaM IDEA [4]
BayEDAcG	**2.3**	*26e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	99	35	15	8.0	3.5	**1.7**	**1.5**	**1.3**	**1.2**	**1.0**	BIPOP-CMA-ES [15]
BFGS	**2.8**	**1**	**1**	**1**	**1**	**2.3**	65	*29e-4/1e4*	.	.	BFGS [30]
(1+1)-CMA-ES	21	**10**	**7.1**	**5.5**	**3.1**	**1.9**	**2.0**	**2.1**	**2.2**	**2.3**	(1+1)-CMA-ES [2]
DASA	**1**	229	588	795	500	387	447	486	572	938	DASA [19]
DEPSO	6.0	*24e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	3.5	822	*43e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1.8**	**8.5**	**5.0**	**3.3**	**1.8**	**1**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	132	57	25	13	5.7	**2.7**	**2.4**	**2.1**	**1.9**	**1.6**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1.6**	88	*53e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1.0**	18	13	10	4.9	**2.8**	**2.8**	**2.7**	**2.7**	**2.7**	NEWUOA [31]
(1+1)-ES	2306	1128	866	654	350	212	213	216	223	225	(1+1)-ES [1]
Monte Carlo	**2.4**	*20e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 132: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{12} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

12 Bent cigar

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	36	40	104	186	229	269	329	526	569	630	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	67	81	179	688	8147	*83e-2/1e5*	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	46	48	21	13	14	16	17	13	14	15	AMaLGaM IDEA [4]
BayEDAcG	66	*44e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.1**	**2.8**	**2.2**	**2.3**	**2.5**	**2.5**	**2.5**	**1.8**	**1.9**	**1.9**	BIPOP-CMA-ES [15]
BFGS	**1.0**	**1.1**	**1**	**1**	**1**	**1**	**1**	4.6	15	657	BFGS [30]
(1+1)-CMA-ES	**1.4**	**1.7**	**2.1**	3.1	4.1	4.4	4.6	3.4	3.6	4.1	(1+1)-CMA-ES [2]
DASA	20	27	38381	34893	*22e+0/1e6*	.	.	.	.	.	DASA [19]
DEPSO	*12e+4/2e3*	.	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	*40e+3/1e5*	.	.	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	17	18	8.6	6.4	7.0	7.3	7.2	5.2	5.4	5.7	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1.8**	**2.8**	**2.8**	3.6	4.2	4.2	3.9	**2.7**	**2.7**	**2.7**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**2.4**	**2.5**	15	24	52	185	*42e-3/1e4*	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1.4**	**1.4**	**1.4**	**1.5**	**1.4**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1.2**	1346	4797	7717	*14e-1/1e6*	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	*16e+7/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 133: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{13} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

13 Sharp ridge

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	3.7	10	51	173	218	297	1798	2098	2462	2985	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	80	179	128	189	862	*85e-3/1e5*	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	88	93	28	12	12	10	**2.0**	**2.0**	**1.9**	**1.9**	AMaLGaM IDEA [4]
BayEDAcG	102	160	*52e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	4.6	5.1	**2.6**	**2.6**	5.0	17	4.4	5.2	5.3	5.9	BIPOP-CMA-ES [15]
BFGS	**1.2**	**1.8**	**1.4**	**1**	**1**	**1**	46	73	*16e-4/4e4*	.	BFGS [30]
(1+1)-CMA-ES	3.3	3.3	**1.7**	4.2	9.5	20	5.6	10	18	48	(1+1)-CMA-ES [2]
DASA	15	24	40	73	154	544	217	943	2854	*21e-5/1e6*	DASA [19]
DEPSO	21	1531	*12e+1/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	544	6841	*91e+0/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	25	33	11	4.5	**4.7**	**4.8**	**1**	**1**	**1**	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.4	4.6	**2.1**	**2.8**	6.3	**8.2**	**2.6**	**2.8**	**2.8**	**2.9**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	4.8	5.9	10	20	71	161	41	*13e-2/1e4*	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**2.0**	**3.0**	13	7.3	15	28	*88e-5/1e4*	NEWUOA [31]
(1+1)-ES	**2.9**	**3.3**	4.7	4.5	18	36	11	37	104	1405	(1+1)-ES [1]
Monte Carlo	*21e+2/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 134: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{14} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

14 Sum of different powers

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	1.0	7.6	16	19	28	55	91	121	1443	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**2.4**	38	59	80	143	514	*27e-5/1e5*	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1.1**	**2.2**	44	46	53	50	30	22	20	**2.1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	3.3	74	89	179	*63e-3/2e3*	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.1**	**2.7**	**2.5**	3.1	3.9	4.4	5.4	**6.6**	**1.1**	BIPOP-CMA-ES [15]
BFGS	**1**	**2.4**	**1.7**	**1.6**	**1.8**	**1.7**	**1.2**	**1**	**1**	*29e-7/2e4*	BFGS [30]
(1+1)-CMA-ES	**1**	**2.3**	**2.1**	**1.7**	**2.0**	**2.2**	**2.2**	**3.2**	**5.3**	**1.0**	(1+1)-CMA-ES [2]
DASA	**1**	4.8	8.7	8.6	13	22	71	499	4649	*58e-7/1e6*	DASA [19]
DEPSO	**1.1**	**1.7**	11	28	295	*11e-2/2e3*	.	.	.	.	DEPSO [12]
simple GA	**1**	3.3	276	392	10987	*17e-2/1e5*	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1**	13	15	19	19	12	9.2	8.6	**1**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.1**	**2.4**	**2.3**	**2.9**	3.7	6.8	8.8	10	**1.5**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	**2.9**	**2.5**	**2.8**	3.0	3.4	3.4	11	*40e-6/1e4*	.	NELDER (Han) [16]
NEWUOA	**1.2**	**2.0**	**1**	**1**	**1**	**1**	**1**	**2.0**	8.6	24	NEWUOA [31]
(1+1)-ES	**1.2**	**2.0**	**1.9**	**1.6**	**1.8**	**2.2**	5.2	37	400	*81e-8/1e6*	(1+1)-ES [1]
Monte Carlo	**1.1**	**1.9**	*29e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]

Table 135: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{15} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

15 Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	4.8	190	4699	19671	26216	26587	26959	27330	27694	28439	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	12	1097	*10e+1/1e5*	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	13	10	**1.9**	**1.5**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.7**	AMaLGaM IDEA [4]
BayEDAcG	23	*24e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.2**	**1**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	28	*53e+1/9e3*	.	.	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	5.1	*34e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	643	*39e+1/1e6*	.	.	.	.	.	.	.	.	DASA [19]
DEPSO	3.7	*35e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	101	2241	*11e+1/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	3.9	**2.9**	10	14	**11**	**11**	**11**	**11**	**10**	**10**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.3**	**1**	**3.6**	*40e-1/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1.6**	*33e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	7.4	*37e+1/7e3*	.	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	447	*42e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	35835	*91e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 136: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{16} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

16 Weierstrass

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	0.03	131	1803	8037	17771	35172	49254	49707	50540	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.1**	11	*38e-1/1e5*	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	17	**3.4**	**3.6**	**4.8**	**3.4**	**3.1**	**3.1**	**3.8**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.3**	*31e+0/2e3*	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1.1**	**1**	**1**	**1.0**	**1.3**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	3.7	*41e+0/2e4*	.	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	**1**	**1.1**	545	*12e+0/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1.2**	1.07e5	*13e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	*35e+0/2e3*	.	.	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1.1**	255	*79e-1/1e5*	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1.1**	**3.1**	4.3	24	27	17	23	**27**	**27**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.1**	**1.8**	**1.5**	**1**	**1**	**1.4**	**3.0**	*30e-3/1e4*	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	**1.1**	95	*10e+0/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1.2**	17	*78e-1/1e4*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	*15e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1.1**	*22e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]

Table 137: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{17} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

17 Schaffer F7, condition 10

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	0.03	10	106	354	874	1299	2216	3331	6637	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.1**	7.0	3766	*12e-1/1e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.3**	13	9.3	4.9	**3.0**	**2.6**	**1.9**	**1.6**	**4.5**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	22	14	*47e-2/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.0**	**1**	**1**	**1**	**1**	**1**	**1**	**1.4**	BIPOP-CMA-ES [15]
BFGS	**1**	5.6	408	*68e-1/3e4*	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	**1**	**1**	67	*68e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	4.2	93571	*98e-1/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.2**	**4.0**	31	*97e-2/2e3*	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1.3**	63	231	*89e-2/1e5*	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1.4**	5.2	**2.6**	**1.5**	**1.0**	54	113	103	62	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1.2**	**1**	**2.1**	**2.4**	**1.6**	**1.6**	**1.3**	**1.3**	**1**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	**1.7**	306	*77e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1.9**	38	*54e-1/1e5*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	7.4	55994	*80e-1/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1.1**	21958	*91e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]

Table 138: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{18} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

18 Schaffer F7, condition 1000

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	0.40	36	425	1177	3179	4685	6422	16776	23736	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.0**	38	*39e-1/1e5*	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1.1**	18	3.3	**1.9**	**1**	**2.2**	**3.0**	**2.6**	**5.0**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	23	35	*16e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1.1**	**2.9**	**1.1**	**1.1**	**1.4**	**1.1**	**1.1**	**1.2**	**1.2**	**1.1**	BIPOP-CMA-ES [15]
BFGS	3.7	618	*28e+0/3e4*	.	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	**1**	3.1	*25e+0/1e4*	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	13	*41e+0/1e6*	.	.	.	.	.	.	.	DASA [19]
DEPSO	**1.1**	**1.5**	25	*57e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
simple GA	**1.1**	**1.3**	104	*46e-1/1e5*	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1.1**	**1.1**	**4.6**	**1**	**1**	9.0	52	54	44	43	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**2.2**	**1**	**1.3**	**1.7**	**1.1**	**1**	**1**	**1**	**1**	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1.1**	12	*29e+0/1e4*	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1.1**	4.2	*20e+0/1e5*	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	103	*35e+0/1e6*	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1**	*32e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]

Table 139: Running time excess ERT/$\mathrm{ERT}_{\mathrm{best}}$ on f_{19} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

19 Griewank-Rosenbrock F8F2

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	0.03	8.8	1412	34806	4.21e5	6.38e5	1.13e6	1.13e6	1.14e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1.2**	6.5	619	*16e-1/1e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	11	**2.4**	**1**	**2.6**	**7.4**	**4.2**	**4.2**	**4.2**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1.1**	18	*57e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**1.1**	**1**	**1.2**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	*19e+0/2e4*	.	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	**1**	**1**	16	*38e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	1.59e6	*16e+0/1e6*	.	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1.1**	3.9	*67e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1.1**	129	1006	*24e-1/1e5*	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1.1**	7.0	11	**46**	***10e-2/1e6***	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	**1.1**	**4.6**	*84e-2/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	**1**	12	*40e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1.2**	**1**	*28e-1/1e5*	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1.4**	7.72e5	*16e+0/1e6*	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1.1**	*14e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]

Table 140: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{20} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

20 Schwefel x*sin(x)

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	3.1	4.3	5.5	3284	4.03e6	nan	nan	nan	nan	nan	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS-GA	45	44	40	*13e-1/1e5*	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	74	62	52	1388	***11e-1/1e6***	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	85	75	64	*34e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	5.4	4.6	4.1	**22**	**1**	***17e-2/6e5***	.	.	.	.	BIPOP-CMA-ES [15]
BFGS	**1.6**	**1.5**	**1.5**	33	***11e-1/3e4***	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	3.6	3.1	**2.7**	*14e-1/1e4*	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	18	16	14	**1**	***57e-2/1e6***	.	.	.	.	.	DASA [19]
DEPSO	20	21	22	*30e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
simple GA	635	567	514	**2.9**	***65e-2/1e5***	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	31	28	23	*15e-1/1e6*	.	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	4.6	4.0	3.5	*16e-1/1e4*	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	4.8	4.6	4.1	*14e-1/1e4*	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	311	***11e-1/3e4***	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**3.4**	**3.0**	**2.6**	1379	***12e-1/1e6***	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	*28e+3/1e6*	.	.	.	.	.	.	.	.	.	Monte Carlo [3]

Table 141: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{21} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

21 Gallagher 101 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	0.03	26	529	2518	2525	2533	2542	2548	2560	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	20	6.5	**2.7**	**3.0**	3.3	3.7	4.2	5.9	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	21	1772	1712	1708	1704	1699	1696	1690	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	37	8.0	*13e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	**2.7**	49	112	112	111	111	111	110	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	**2.9**	**2.3**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	9.3	BFGS [30]
(1+1)-CMA-ES	**1**	**1**	4.1	**1.8**	**1.7**	**1.7**	**1.7**	**1.7**	**1.6**	**1.6**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	46	44	27	27	27	27	27	27	DASA [19]
DEPSO	**1**	**1**	18	16	12	*33e-1/2e3*	.	.	.	.	DEPSO [12]
simple GA	**1**	**1**	120	768	559	*25e-1/1e5*	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1**	38	659	848	847	845	843	842	841	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	3.4	19	16	16	16	16	16	16	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	**1**	13	14	5.6	5.5	5.5	5.5	5.5	5.5	NELDER (Han) [16]
NEWUOA	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	3.6	5.2	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	(1+1)-ES [1]
Monte Carlo	**1**	**1**	*69e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]

Table 142: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{22} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

22 Gallagher 21 peaks

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	0.03	0.03	116	886	16210	16230	16250	16273	16297	16351	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	**1**	**1**	8.5	12	35	114	*69e-2/1e5*	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	2172	761	*69e-2/1e6*	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	18	10	*73e-1/2e3*	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	6.4	60	*69e-2/1e5*	.	.	.	.	.	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	**1**	**1.5**	*69e-2/8e3*	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	**1**	**1**	**2.7**	**1.8**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	(1+1)-CMA-ES [2]
DASA	**1**	**1**	32	31	45	45	45	45	45	45	DASA [19]
DEPSO	**1**	**1**	7.3	10	*26e-1/2e3*	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1**	87	178	*20e-1/1e5*	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1**	372	757	*69e-2/1e6*	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	13	6.0	*69e-2/1e4*	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	**1**	4.7	3.8	9.0	9.0	9.0	8.9	8.9	8.9	NELDER (Han) [16]
NEWUOA	**1**	**1**	**2.7**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	NEWUOA [31]
(1+1)-ES	**1**	**1**	3.3	**2.7**	**6.6**	**6.6**	**6.6**	**6.6**	**6.6**	**6.6**	(1+1)-ES [1]
Monte Carlo	**1**	**1**	*71e+0/1e6*	.	.	.	.	.	.	.	Monte Carlo [3]

Table 143: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{23} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

23 Katsuuras

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$	0.03	0.03	0.24	298	1886	16522	31967	78995	81054	84011	$\mathrm{ERT}_{\mathrm{best}}/\mathrm{D}$
ALPS-GA	**1**	**1**	**1**	147	*80e-2/1e5*	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	**1**	**1**	**1.1**	12	**2.5**	**1**	**1**	**1**	**1**	**1**	AMaLGaM IDEA [4]
BayEDAcG	**1**	**1**	**1.1**	*37e-1/2e3*	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**1**	**1**	5.6	4.8	**1**	**1.6**	**2.0**	**1.4**	**1.4**	**1.4**	BIPOP-CMA-ES [15]
BFGS	**1**	**1**	58	263	*30e-1/5e3*	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	**1**	**1**	12	12	*82e-2/1e4*	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	**1**	**1**	**1.5**	76	*68e-2/6e5*	.	.	.	.	.	DASA [19]
DEPSO	**1**	**1**	**1.2**	*44e-1/2e3*	.	.	.	.	.	.	DEPSO [12]
simple GA	**1**	**1**	**1.1**	437	*79e-2/1e5*	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	**1**	**1**	**1.1**	**2.3**	**1.1**	**3.1**	**12**	**8.1**	**8.0**	**7.7**	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**1**	**1**	6.2	4.9	6.3	*89e-3/1e4*	.	.	.	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	**1**	**1**	**1.3**	**1**	*29e-2/1e4*	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	**1**	7.1	**1.8**	*46e-2/8e3*	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	**1**	**1**	24	278	*73e-2/1e6*	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	**1**	**1**	**1.4**	*22e-1/1e6*	.	.	.	.	.	.	Monte Carlo [3]

Table 144: Running time excess $\mathrm{ERT}/\mathrm{ERT}_{\mathrm{best}}$ on f_{24} in **40-D**, in italics is given the median final function value and the median number of function evaluations to reach this value divided by dimension

24 Lunacek bi-Rastrigin

Δftarget	1e+03	1e+02	1e+01	1e+00	1e-01	1e-02	1e-03	1e-04	1e-05	1e-07	Δftarget
$\mathrm{ERT}_{\mathrm{best}}$/D	2.1	967	1.46e5	2.45e6	7.50e6	7.51e6	7.51e6	7.51e6	7.51e6	7.51e6	$\mathrm{ERT}_{\mathrm{best}}$/D
ALPS-GA	5.8	82	*91e+0/1e5*	.	.	.	.	.	.	.	ALPS-GA [17]
AMaLGaM IDEA	13	**4.2**	17	***42e+0/1e6***	.	.	.	.	.	.	AMaLGaM IDEA [4]
BayEDAcG	15	*28e+1/2e3*	.	.	.	.	.	.	.	.	BayEDAcG [10]
BIPOP-CMA-ES	**2.3**	12	**4.6**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	BIPOP-CMA-ES [15]
BFGS	560	*89e+1/8e3*	.	.	.	.	.	.	.	.	BFGS [30]
(1+1)-CMA-ES	**2.3**	*34e+1/1e4*	.	.	.	.	.	.	.	.	(1+1)-CMA-ES [2]
DASA	3218	*55e+1/1e6*	.	.	.	.	.	.	.	.	DASA [19]
DEPSO	6.6	*37e+1/2e3*	.	.	.	.	.	.	.	.	DEPSO [12]
simple GA	107	1465	*14e+1/1e5*	.	.	.	.	.	.	.	simple GA [22]
iAMaLGaM IDEA	6.6	**1**	**8.5**	***10e+0/1e6***	.	.	.	.	.	.	iAMaLGaM IDEA [4]
IPOP-SEP-CMA-ES	**2.3**	**1.5**	**1**	***46e+0/1e4***	.	.	.	.	.	.	IPOP-SEP-CMA-ES [29]
NELDER (Han)	28	*64e+1/1e4*	.	.	.	.	.	.	.	.	NELDER (Han) [16]
NEWUOA	**1**	*25e+1/9e3*	.	.	.	.	.	.	.	.	NEWUOA [31]
(1+1)-ES	1719	*49e+1/1e6*	.	.	.	.	.	.	.	.	(1+1)-ES [1]
Monte Carlo	646	*82e+1/1e6*	.	.	.	.	.	.	.	.	Monte Carlo [3]

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